L3.14.28_1.0.0_GA
OTT Box Porting Notes

i.MX FAE   August 2015

freescale™

Agenda

- **Source Codes Changes**
  - ➢ **U-boot**
  - ➢ **Linux Kernel**
  - ➢ **Device Tree**

- **Yocto Project Modification**

- **Image Building Instructions**

- **QA**

Source Codes Changes

- **Here we focus on below source codes**

    - ➤ **U-boot**

    - ➤ **Linux Kernel**

    - ➤ **Device Tree**

- **The modified source codes please refer to below files for more details.**

    L3.14.28_1.0.0_ga_150805_ottbox_addon.zip

freescale™

u-boot

What's new in u-boot-2014.04

- **Devices Tree Support**

- **board definitions are in the boards.cfg**

  Snatch:

  Active arm   armv7   mx6   freescale   mx6sabresd
  mx6qsabresd
  mx6sabresd:IMX_CONFIG=board/freescale/imx/ddr/mx6q_4x_mt41j128.cf
  g,MX6Q,DEFAULT_FDT_FILE="imx6q-
  sabresd.dtb",DDR_MB=1024,SYS_USE_SPINOR

What's new in u-boot-2014.04 – DCD

- **The DCD is pointed by IMX_CONFIG**

Active arm   armv7   mx6   freescale   mx6sabresd
mx6qsabresd
mx6sabresd:IMX_CONFIG=board/freescale/imx/ddr/mx6q_4x_mt41j128.cfg,
MX6Q,DEFAULT_FDT_FILE="imx6q-
sabresd.dtb",DDR_MB=1024,SYS_USE_SPINOR

This change makes the DDR configuration in the IMX_CONFIG file
Note: u-boot 2009.08 DDR configuration is in the flash_header.S

Ex: board/freescale/imx/ddr/mx6q_4x_mt41j128.cfg
    board/freescale/mx6qsabreauto/mx6q.cfg

What's new in u-boot-2014.04 – DCD (Cont.)

- **The DCD is taken care by the mkimage**

tools/mkimage.c

```
145 int
146 main (int argc, char **argv)
147 {
148      int ifd = -1;
149      struct stat sbuf;
150      char *ptr;
151      int retval = 0;
152      struct image_type_params *tparams = NULL;
153
154      /* Init Freescale PBL Boot image generation/list support */
155      init_pbl_image_type();
156      /* Init Kirkwood Boot image generation/list support */
157      init_kwb_image_type ();
158      /* Init Freescale imx Boot image generation/list support */
159      init_imx_image_type ();
160      /* Init FIT image generation/list support */
```

tools/imximage.c

```
35 /*
36  * Supported commands for configuration file
37  */
38 static table_entry_t imximage_cmds[] = {
39      {CMD_BOOT_FROM,       "BOOT_FROM",
"boot command",  },
40      {CMD_DATA,            "DATA",
"Reg Write Data", },
41      {CMD_IMAGE_VERSION,
"IMAGE_VERSION",       "image version",  },
42      {CMD_PLUGIN,          "PLUGIN",
"file plugin_addr",  },
43      {CMD_SECURE_BOOT,
"SECURE_BOOT",         "secure boot enable", },
44      {-1,              "",              "",            },
45 };
46
```

board/freescale/mx6ottbox/mx6qottbox
_4x_mt41j128.cfg

DATA 4, 0x020e056c, 0x00000030
DATA 4, 0x020e0578, 0x00000030

What's new in u-boot-2014.04 – Compile Flag

- **The compile flag could be passed from boards.cfg**

  Any FLAG in the boards.cfg will become compile flag, which is prefixed with
  CONFIG_ in the u-boot C files

  Active arm   armv7   mx6   freescale   mx6sabresd
  mx6qsabresd
  mx6sabresd:IMX_CONFIG=board/freescale/imx/ddr/mx6q_4x_mt41j128.cfg,
  MX6Q,DEFAULT_FDT_FILE="imx6q-
  sabresd.dtb",DDR_MB=1024,SYS_USE_SPINOR

  The DDR_MB will become CONFIG_DDR_MB flag.
  The SYS_USE_SPINOR will become CONFIG_ SYS_USE_SPINOR flag.

What's new in u-boot-2014.04 – LDO Bypass

- LDO passby in u-boot: it is moved from linux kernel to u-boot

   A flag **fsl,ldo-bypass** in device tree will tell u-boot to do ldo bypass to ldo enable

arch/arm/boot/dts /imx6qdl-sabresd.dtsi

```
&gpc {
        fsl,cpu_pupscr_sw2iso = <0xf>;
        fsl,cpu_pupscr_sw = <0xf>;
        fsl,cpu_pdnscr_iso2sw = <0x1>;
        fsl,cpu_pdnscr_iso = <0x1>;
        fsl,ldo-bypass = <1>; /* use ldo-bypass, u-boot will check it and configure */
        fsl,wdog-reset = <2>; /* watchdog select of reset source */
         pu-supply = <&pu_dummy>; /* ldo-bypass:use pu_dummy if VDDSOC share with VDDPU */
};
```

arch/arm/imx-common/cpu.c   +200

```
void arch_preboot_os(void)
{
#if defined(CONFIG_LDO_BYPASS_CHECK)

    ldo_mode_set(check_ldo_bypass());
#endif
#if defined(CONFIG_VIDEO_IPUV3)
    /* disable video before launching O/S */
    ipuv3_fb_shutdown();
#endif
}
```

arch/arm/cpu/armv7/mx6/soc.c   +838

```
int check_ldo_bypass(void)
 {   ……………
node = fdt_node_offset_by_compatible(gd->fdt_blob, -1,
"fsl,imx6q-gpc");
………..
ldo_mode = fdt_getprop(gd->fdt_blob, node, "fsl,ldo-bypass", NULL);
………
}
```

freescale™

What's new in u-boot-2014.04 – LDO Bypass (Cont.)

- set_anatop_bypass called for ldo bypass in u-boot

```
#ifdef CONFIG_LDO_BYPASS_CHECK
void ldo_mode_set(int ldo_bypass)
{
    /* switch to ldo_bypass mode , boot on 800Mhz */
    if (ldo_bypass) {
    …………………
    …………………
    …………………
    prep_anatop_bypass();
    (void)set_anatop_bypass(2);
    finish_anatop_bypass();
    printf("switch to ldo_bypass mode!\n");
    }
}
#endif
#endif
```

What's new in u-boot-2014.04 – LDO Bypass (Cont.)

- Set the DCDC1 and DCDC2 voltage to ldo bypass voltage

  OTTBOX:

  wolfson DCDC1   --- vdd_arm

                 DCDC2   --- vdd_soc

  Set the voltage to the ldo bypass voltage before switch to ldo bypass mode

						outputs (VDD_SOC_CAP and VDD_PU_CAP) require 1.15 V minimum.
Run mode: LDO bypassed	VDD_ARM_IN VDD_ARM23_IN[2]	1.225	—	1.3	V	LDO bypassed for operation up to 852 MHz or 996 MHz (depending on the device speed grade).
		1.125	—	1.3	V	LDO bypassed for operation up to 792 MHz.
		0.925	—	1.3	V	LDO bypassed for operation up to 396 MHz.
	VDD_SOC_IN[5]	1.225[6]	—	1.3	V	264 MHz < VPU ≤ 352 MHz
		1.15[6]	—	1.3	V	VPU ≤ 264 MHz
Standby/DSM Mode	VDD_ARM_IN VDD_ARM23_IN[2]	0.9	—	1.3	V	See Table 10, "Stop Mode Current and Power Consumption," on page 25.
	VDD_SOC_IN	0.9	—	1.3	V	

freescale™

Changes for OTTBox – IOMUX, PMIC I2C Function Mapping

- IOMUX changes for nand, emmc, sdcard and i2c

  nand   ---   iomux_v3_cfg_t gpmi_pads[]

  emmc   ---   iomux_v3_cfg_t const usdhc2_pads[]

  sdcard   ---   iomux_v3_cfg_t const usdhc3_pads[]

  i2c   ---   struct i2c_pads_info i2c_pad_info1

- Wolfson 16bit i2c function mapping

```c
static unsigned short wm831x_reg_read(uchar chip, unsigned short reg)
{
    unsigned short val = 0;
    i2c_read(chip, (unsigned int)reg, 2, (uchar *)&val, 2);
    val = uswap_16(val);        return val;
}
```

Note: int i2c_read(uchar chip, uint addr, int **alen**, uchar *buf, int **len**)

```c
int wm831x_reg_write(uchar chip, unsigned short reg, unsigned short val)
{       val = uswap_16(val);
        return i2c_write(chip, (unsigned int)reg, 2, (uchar *)&val, 2);
}
```

Note: int i2c_write(uchar chip, uint addr, int **alen**, uchar *buf, int **len**)

freescale™

Changes for OTTBox – MMC Index Fixed

- **U-boot environment variable: root=/dev/mmcblk2p2**

  in include\configs\mx6ottbox_common.h,

#define CONFIG_EXTRA_ENV_SETTINGS \

…

  "bootargs=console=" CONFIG_CONSOLE_DEV ",115200
  video=mxcfb0:dev=hdmi,1920x1080M@60,if=RGB24 " \

         "root=/dev/mmcblk2p2 rootwait "   \

Make above changes to align with below settings in device tree:
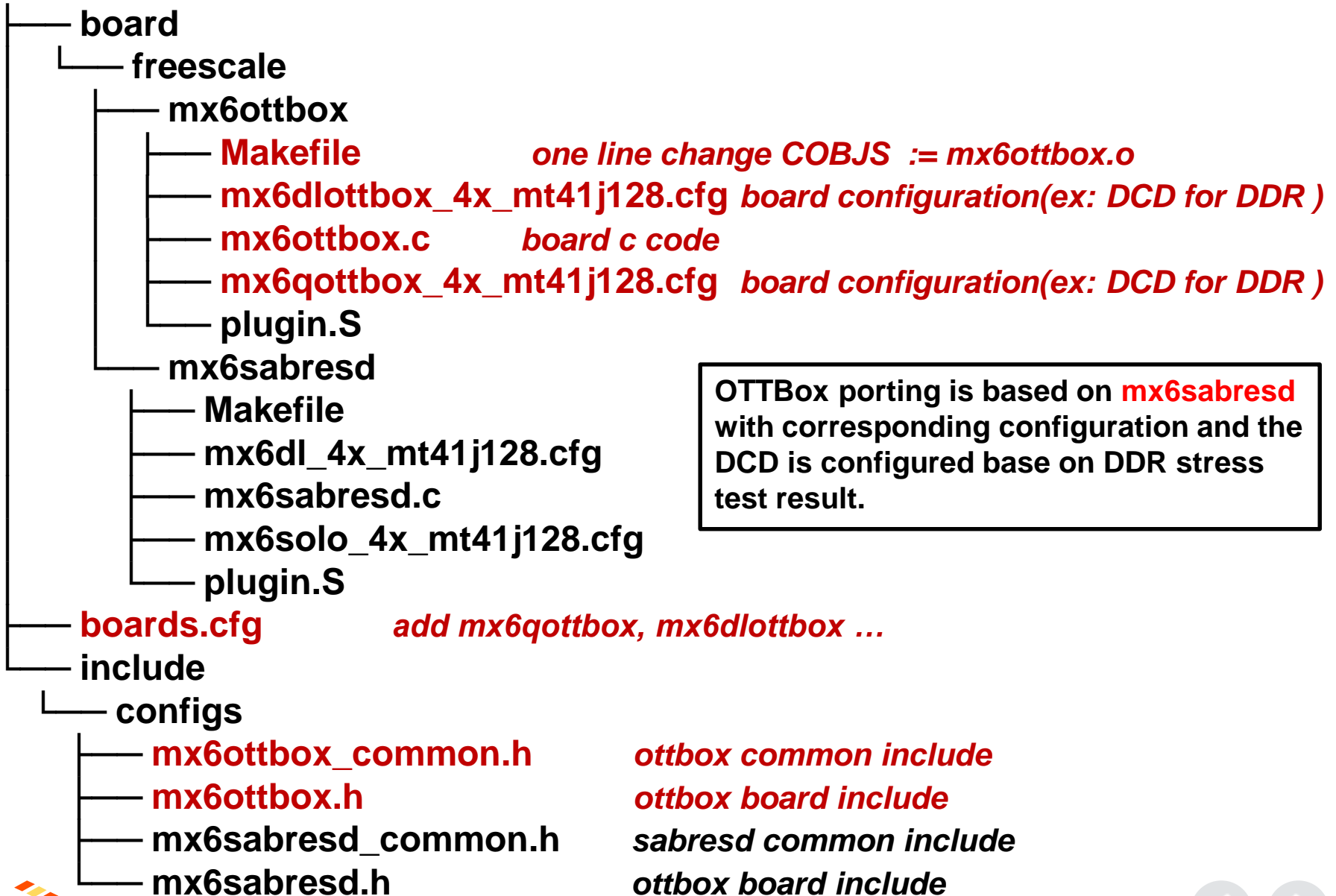arch\arm\boot\dts\imx6qdl.dtsi
         aliases {

…

                 mmc0 = &usdhc1;
                 mmc1 = &usdhc2;
                 mmc2 = &usdhc3;
                 mmc3 = &usdhc4;

freescale ™

Add new files in u-boot source codes

```
─── board
    └── freescale
        ├── mx6ottbox
        │   ├── Makefile                    one line change COBJS := mx6ottbox.o
        │   ├── mx6dlottbox_4x_mt41j128.cfg board configuration(ex: DCD for DDR )
        │   ├── mx6ottbox.c        board c code
        │   ├── mx6qottbox_4x_mt41j128.cfg  board configuration(ex: DCD for DDR )
        │   └── plugin.S
        └── mx6sabresd
            ├── Makefile
            ├── mx6dl_4x_mt41j128.cfg
            ├── mx6sabresd.c
            ├── mx6solo_4x_mt41j128.cfg
            └── plugin.S
── boards.cfg              add mx6qottbox, mx6dlottbox …
── include
    └── configs
        ├── mx6ottbox_common.h      ottbox common include
        ├── mx6ottbox.h             ottbox board include
        ├── mx6sabresd_common.h     sabresd common include
        └── mx6sabresd.h            ottbox board include
```

> **OTTBox porting is based on mx6sabresd with corresponding configuration and the DCD is configured base on DDR stress test result.**

freescale™

Linux Kernel

What's New in L3.14.28

- Device Tree
- Configuration Based on arm core version

  imx_v4_v5_defconfig

  imx_v7_defconfig

  imx_v7_mfg_defconfig

freescale™

Major changes in kernel for OTTBox

- Disable the Touch Screen

-> Device Drivers

   -> Input device support

     -> Touchscreens

- Add Micrel KSZ886X Switch KSZ8081 fixup

  arch/arm/mach-imx/mach-imx6q.c

```
static int ksz8081rn_phy_fixup(struct phy_device *dev)
{
    dev->dev_flags |= MICREL_PHY_50MHZ_CLK;
}
static void __init imx6q_enet_phy_init(void)
{
    if (IS_BUILTIN(CONFIG_PHYLIB)) {
        ......................
        phy_register_fixup_for_uid(PHY_ID_KSZ8081, MICREL_PHY_ID_MASK,
            ksz8081rn_phy_fixup);
        ......................
    }
}
```

Major changes in kernel for OTTBox (cont.)

• Add configuration symbol for DCDC ldo bypass with cpu frequency scaling

Configuration:

CPU Power Management --->

    CPU Frequency scaling --->

      ARM CPU frequency scaling drivers --->

        [*] Freescale i.MX6 cpufreq support DCDC with ldo-bypass

Source code changes:

drivers/cpufreq/imx6q-cpufreq.c

```
#if !defined(CONFIG_ARM_IMX6_CPUFREQ_DCDC_LDOBYPASS)
    /* scaling up?  scale voltage before frequency */
    if (freqs.new > freqs.old) {
…………
```

Add WIFI support for OTTBox

- add wifi support for REALTEK RTL8723AS.

  L3.14.28_1.0.0_GA doesn't support wifi module rtl8723as (SDIO) on OTTBox board.

- copy the driver source codes from KK4.4.3 kernel source codes drivers/net/wireless/rtlwifi/rtl8723as

- modify Kconfig and Makefile in the directory add below:

in Kconfig

```
config RTL8723AS
    tristate "Realtek RTL8723as Wireless Network Adapter"
    depends on RTLWIFI
    ---help---
    This is the driver for Realtek RTL8723as sdio wireless network adapters
```

in Makefile

```
obj-$(CONFIG_RTL8723AS)        += rtl8723as/
```

Add WIFI support for OTTBox (cont.)

- configuration:

ARCH=arm make menuconfig

device drivers --->
    network device support   --->
                       wireless LAN --->
                       <*> Realtek RTL8723as Wireless Network Adapter

Device Tree

How to build the Device Tree

dts file name ABC.dts

Build command line

 ARCH=arm make CROSS_COMPILE=arm-poky-linux-gnueabi- ABC.dtb

Example:

To build

arch/arm/boot/dts/imx6q-sabresd.dts

 ARCH=arm make CROSS_COMPILE=arm-poky-linux-gnueabi- imx6q-
   sabresd.dtb

The Device Tree Compiler (DTC)

The device tree compiler is located in the scripts/dtc

The dtc compiles the dts file to dtb: DTS → DTC → DTB

The following is the DTB format

struct boot_param_header
(alignment gap) (*)
memory reserve map
(alignment gap) (*)
device-tree structure
(alignment gap) (*)
device-tree strings

What is Device tree

Device Tree is a matching mechanism outside of the linux kernel replacing old matching mechanism.

Old matching: driver/base

Driver:

```
Drivers\mfd\ pfuze-core.c
static const struct i2c_device_id pfuze_device_id[] =
    {
    {"pfuze100", 0},
    {},
};

enum pfuze_id {
    PFUZE_ID_PFUZE100,
    PFUZE_ID_INVALID,
};
static const char *pfuze_chipname[] = {
    [PFUZE_ID_PFUZE100] = "pfuze100",
};
```

Board init:

```
arch\arm\mach-mx6 \ board-mx6q_sabresd.c
mx6q_sabresd_init_pfuze100



arch\arm\mach-mx6\mx6q_sabresd_pmic_pfuze100.c


static struct i2c_board_info __initdata pfuze100_i2c_device = {
    I2C_BOARD_INFO(PFUZE100_I2C_DEVICE_NAME,
    PFUZE100_I2C_ADDR),
    .platform_data = &pfuze100_plat,
};


int __init mx6q_sabresd_init_pfuze100(u32 int_gpio)
{
    pfuze100_i2c_device.irq = gpio_to_irq(int_gpio); /*update INT gpio */
    return i2c_register_board_info(1, &pfuze100_i2c_device, 1);
}
```

freescale™

What is Device tree (cont.)

Device Tree matching: driver/of

Driver:

drivers\regulator\pfuze100-regulator.c

```
static const struct of_device_id pfuze_dt_ids[] = {
    { .compatible = "fsl,pfuze100" },
    {},
};

static struct i2c_driver pfuze_driver = {
    .id_table = pfuze_device_id,
    .driver = {
                .name = "pfuze100-regulator",
                .owner = THIS_MODULE,
                .of_match_table = pfuze_dt_ids,
    },
    .probe = pfuze100_regulator_probe,
    .remove = pfuze100_regulator_remove,
};
```

Device Tree:

arch/arm/boot/dts/imx6qdl-sabresd.dtsi

```
&i2c2 {
……
……
 pmic: pfuze100@08 {
compatible = "fsl,pfuze100";
reg = <0x08>;
```

Platform Matching Vs. Device Tree Matching Example

L3.0.35_410
board-mx6q_sabresd.c

```
796 static struct i2c_board_info mxc_i2c0_board_info[]
    __initdata = {
797     {
798         I2C_BOARD_INFO("wm89**", 0x1a),
799     },
800     {
801         I2C_BOARD_INFO("ov564x", 0x3c),
802         .platform_data = (void *)&camera_data,
803     },
804     {
805         I2C_BOARD_INFO("mma8451", 0x1c),
806         .platform_data = (void *)&mma8451_position,
807     },
808 };
809

1816     i2c_register_board_info(0, mxc_i2c0_board_info,
1817                 ARRAY_SIZE(mxc_i2c0_board_info));
```

Note: In Old kernel the i2c index is **Zero** Base
(i2c0, i2c1, i2c2)

L3.14.28_1.0.0_ga
imx6qdl-sabresd.dtsi

```
317 &i2c1 {
318     clock-frequency = <100000>;
319     pinctrl-names = "default";
320     pinctrl-0 = <&pinctrl_i2c1_2>;
321     status = "okay";
322
323     codec: wm8962@1a {
324         compatible = "wlf,wm8962";
325     reg = <0x1a>;
326 .........
327     };
328
329     ov564x: ov564x@3c {
330         compatible = "ovti,ov564x";
331         reg = <0x3c>;
332 .........
333     };
334
335     mma8451@1c {
336         compatible = "fsl,mma8451";
337         reg = <0x1c>;
338 .........
339     };
340 };
```

Note: In device tree, the i2c index is **One**
Base (i2c1, i2c2, i2c3)

Bindings

All the devices supported by devices have the binding document in the following directory.

Any device NOT in the bindings could not be supportted by the devices tree matching.

But still can use platform matching(old way) but ugly code

Documentation/devicetree/bindings

Snatch:

Documentation\devicetree\bindings\net\fsl-fec.txt

```
* Freescale Fast Ethernet Controller (FEC)
Required properties:
- compatible : Should be "fsl,<soc>-fec"
- reg : Address and length of the register set for the device
- interrupts : Should contain fec interrupt
- phy-mode : String, operation mode of the PHY interface. Supported values are: "mii", "gmii", "sgmii", "tbi", "rmii",
  "rgmii", "rgmii-id", "rgmii-rxid", "rgmii-txid", "rtbi", "smii".
Optional properties:
- local-mac-address : 6 bytes, mac address
- phy-reset-gpios : Should specify the gpio for phy reset
- phy-reset-duration : Reset duration in milliseconds.  Should present only if property "phy-reset-gpios" is available.  Missing the property will have the duration be 1 millisecond.
      Numbers greater than 1000 are invalid and 1 millisecond will be used instead.
Example:
ethernet@83fec000 { compatible = "fsl,imx51-fec", "fsl,imx27-fec";
      reg = <0x83fec000 0x4000>;
      interrupts = <87>;
      phy-mode = "mii";
      phy-reset-gpios = <&gpio2 14 0>; /* GPIO2_14 */
      local-mac-address = [00 04 9F 01 1B B9];
```

Device Tree Dependency

After making dtb, below files will be generated in arch/arm/boot/dts/ directory:

```
imx6q-sabresd.dtb
.imx6q-sabresd.dtb.cmd
.imx6q-sabresd.dtb.d.dtc.tmp
.imx6q-sabresd.dtb.d.pre.tmp
.imx6q-sabresd.dtb.dts.tmp
```
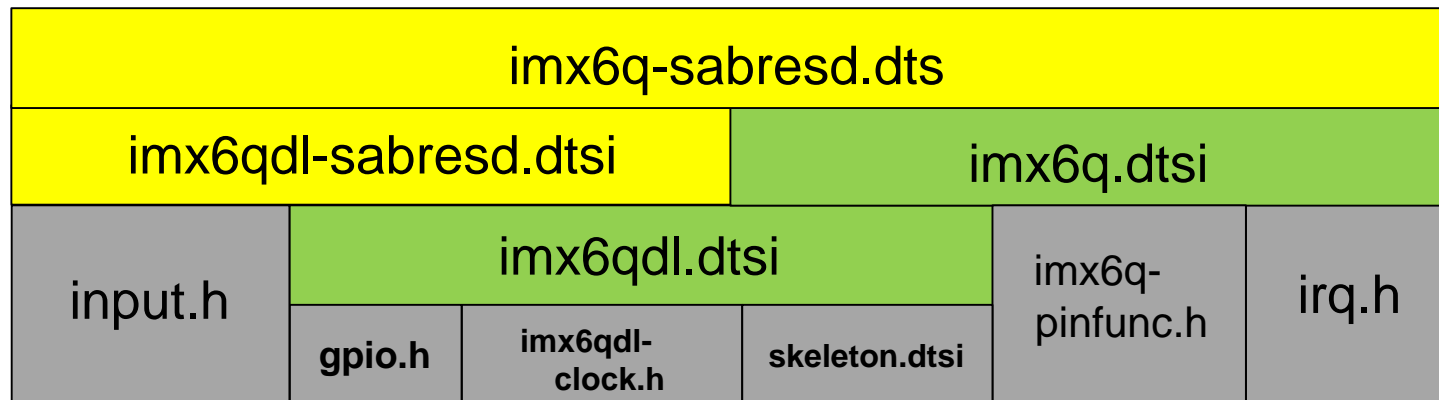
In the file .imx6q-sabresd.dtb.cmd we could get the device tree dependency:

```
deps_arch/arm/boot/dts/imx6q-sabresd.dtb := \
    arch/arm/boot/dts/imx6q.dtsi \
    ----arch/arm/boot/dts/include/dt-bindings/interrupt-controller/irq.h \
    ----arch/arm/boot/dts/imx6q-pinfunc.h \
    ----arch/arm/boot/dts/imx6qdl.dtsi \
    --------arch/arm/boot/dts/include/dt-bindings/clock/imx6qdl-clock.h \
    --------arch/arm/boot/dts/include/dt-bindings/gpio/gpio.h \
    --------arch/arm/boot/dts/skeleton.dtsi \
    arch/arm/boot/dts/imx6qdl-sabresd.dtsi \
    ----arch/arm/boot/dts/include/dt-bindings/input/input.h \
```

freescale ™

Device Tree Dependency (cont.)

```
deps_arch/arm/boot/dts/imx6q-sabresd.dtb := \
    arch/arm/boot/dts/imx6q.dtsi \
    ----arch/arm/boot/dts/include/dt-bindings/interrupt-controller/irq.h \
    ----arch/arm/boot/dts/imx6q-pinfunc.h \
    ----arch/arm/boot/dts/imx6qdl.dtsi \
    --------arch/arm/boot/dts/include/dt-bindings/clock/imx6qdl-clock.h \
    --------arch/arm/boot/dts/include/dt-bindings/gpio/gpio.h \
    --------arch/arm/boot/dts/skeleton.dtsi \
    arch/arm/boot/dts/imx6qdl-sabresd.dtsi \
    ----arch/arm/boot/dts/include/dt-bindings/input/input.h \
```
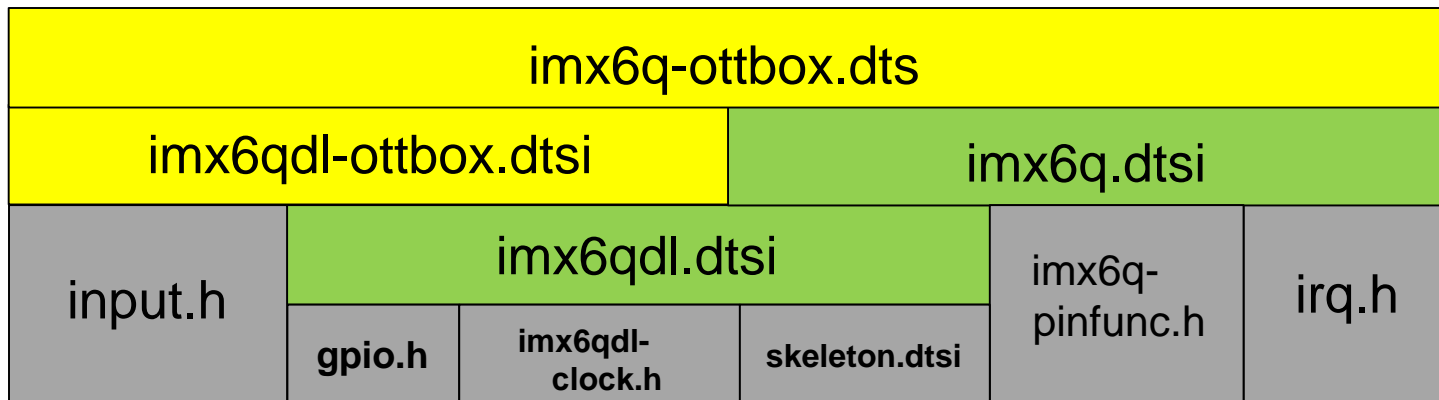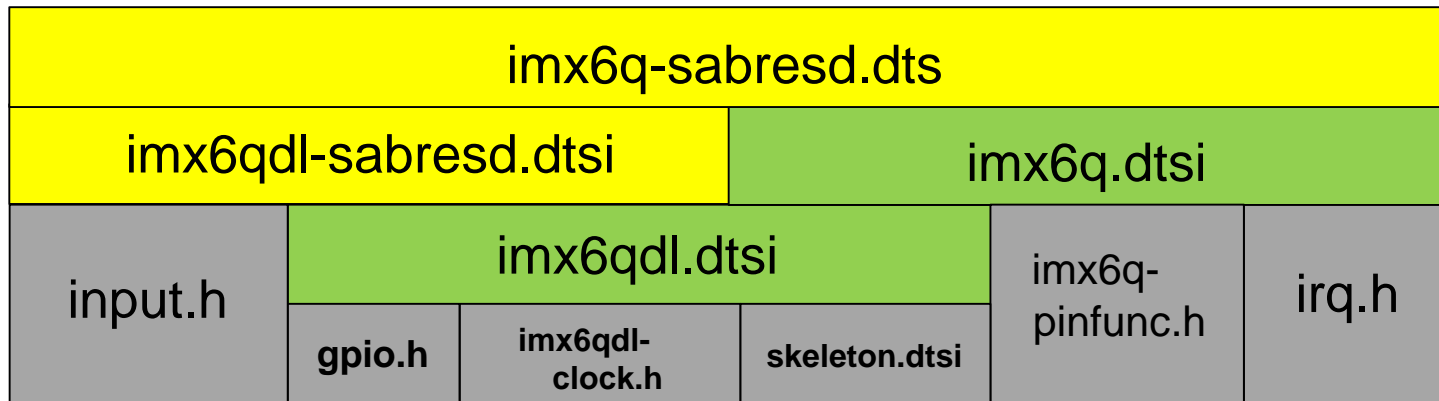
imx6q-sabresd.dts						
imx6qdl-sabresd.dtsi				imx6q.dtsi		
input.h	imx6qdl.dtsi			imx6q-pinfunc.h	irq.h	
	gpio.h	imx6qdl-clock.h	skeleton.dtsi			

board level   chip level   head file

freescale™

OTTBox Device Tree Dependency (compare with SabreSD)

imx6q-sabresd.dts				
imx6qdl-sabresd.dtsi		imx6q.dtsi		
input.h	imx6qdl.dtsi		imx6q-pinfunc.h	irq.h
	gpio.h / imx6qdl-clock.h / skeleton.dtsi			

imx6q-ottbox.dts				
imx6qdl-ottbox.dtsi		imx6q.dtsi		
input.h	imx6qdl.dtsi		imx6q-pinfunc.h	irq.h
	gpio.h / imx6qdl-clock.h / skeleton.dtsi			

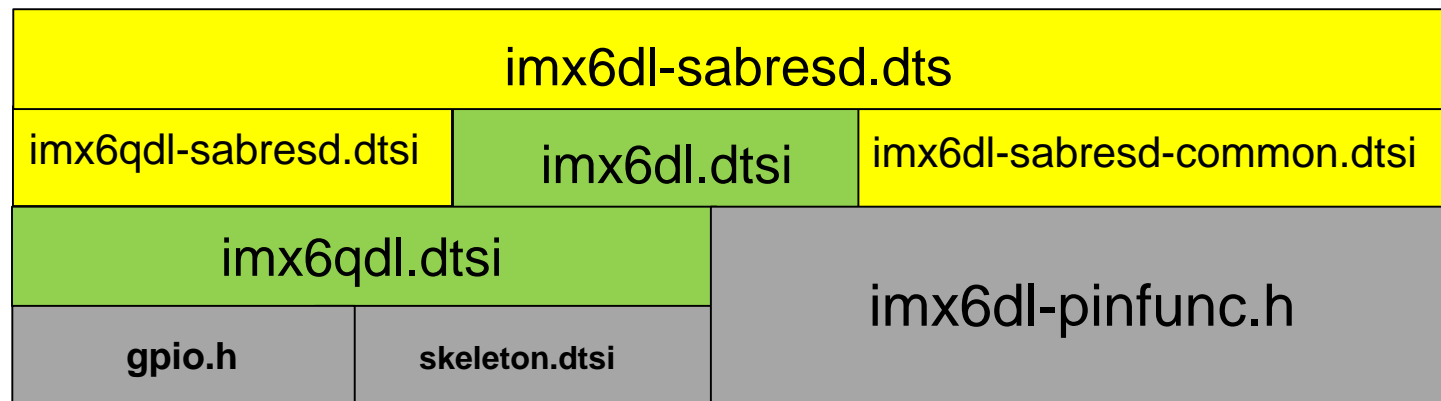**board level** (yellow)   **chip level** (green)   **head file** (gray)

Device Tree Dependency (cont.)

L3.10.53_1.1.0 for mx6q-sabresd

arch/arm/boot/dts/.imx6q-sabresd.dtb.cmd:

```
deps_arch/arm/boot/dts/imx6q-sabresd.dtb := \
 arch/arm/boot/dts/imx6q.dtsi \
 ----arch/arm/boot/dts/imx6q-pinfunc.h \
 ----arch/arm/boot/dts/imx6qdl.dtsi \
 --------arch/arm/boot/dts/skeleton.dtsi \
 --------arch/arm/boot/dts/include/dt-bindings/gpio/gpio.h \
 arch/arm/boot/dts/imx6qdl-sabresd.dtsi \
```

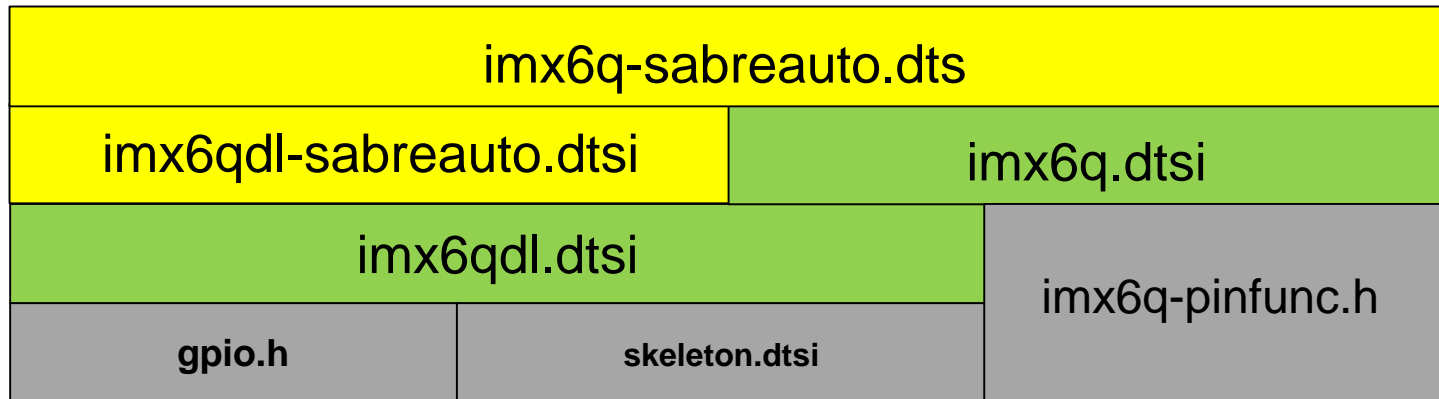| imx6q-sabresd.dts		
imx6qdl-sabresd.dtsi	imx6q.dtsi	
imx6qdl.dtsi		imx6q-pinfunc.h
gpio.h	skeleton.dtsi	
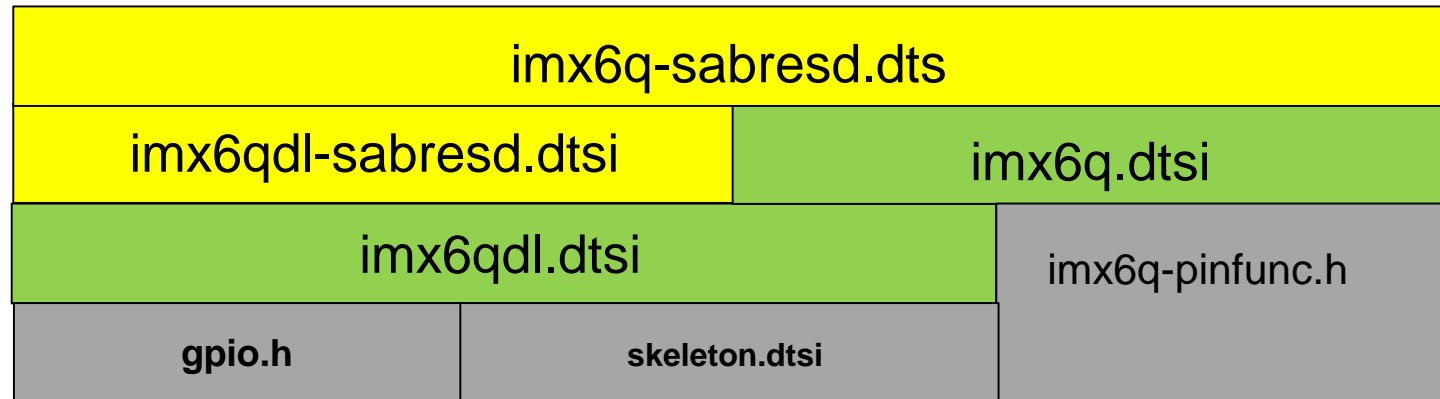
Device Tree Dependency (cont.)

L3.10.53_1.1.0 for mx6dl-sabresd

arch/arm/boot/dts/.imx6dl-sabresd.dtb.cmd:

```
deps_arch/arm/boot/dts/imx6dl-sabresd.dtb := \
 arch/arm/boot/dts/imx6dl.dtsi \
 ----arch/arm/boot/dts/imx6dl-pinfunc.h \
 ----arch/arm/boot/dts/imx6qdl.dtsi \
 --------arch/arm/boot/dts/skeleton.dtsi \
 --------arch/arm/boot/dts/include/dt-bindings/gpio/gpio.h \
 arch/arm/boot/dts/imx6qdl-sabresd.dtsi \
 arch/arm/boot/dts/imx6dl-sabresd-common.dtsi \
```
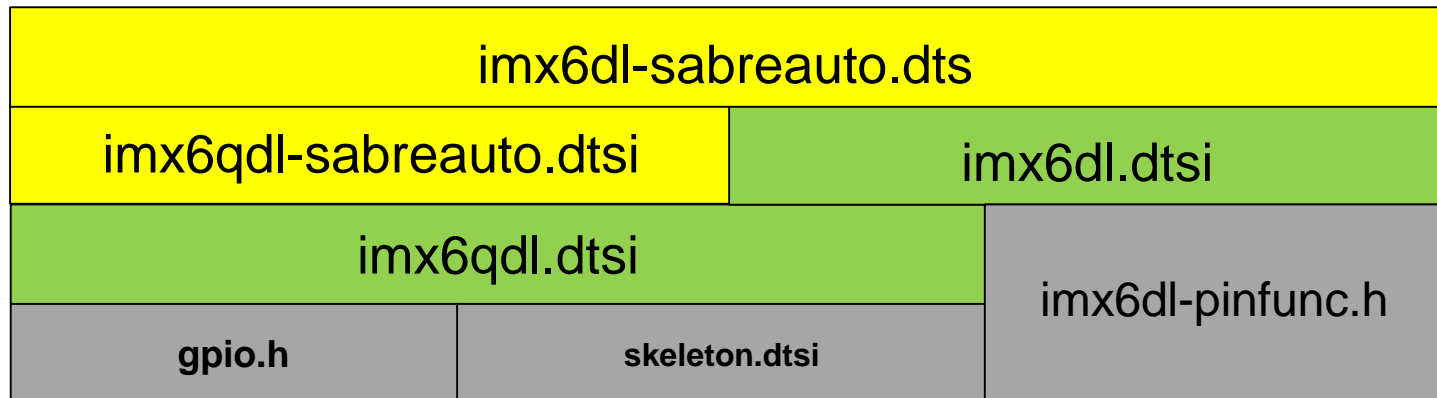
Device Tree Dependency (cont.)

L3.10.53_1.1.0 for mx6q-sabreauto

arch/arm/boot/dts/.imx6q-sabreauto.dtb.cmd:

```
deps_arch/arm/boot/dts/imx6q-sabreauto.dtb := \
  arch/arm/boot/dts/imx6q.dtsi \
  ----arch/arm/boot/dts/imx6q-pinfunc.h \
  ----arch/arm/boot/dts/imx6qdl.dtsi \
  --------arch/arm/boot/dts/skeleton.dtsi \
  --------arch/arm/boot/dts/include/dt-bindings/gpio/gpio.h \
  arch/arm/boot/dts/imx6qdl-sabreauto.dtsi \
```

Device Tree Dependency (cont.)

L3.10.53_1.1.0 for mx6dl-sabreauto

arch/arm/boot/dts/.imx6dl-sabreauto.dtb.cmd:

```
deps_arch/arm/boot/dts/imx6dl-sabreauto.dtb := \
 arch/arm/boot/dts/imx6dl.dtsi \
 ----arch/arm/boot/dts/imx6dl-pinfunc.h \
 ----arch/arm/boot/dts/imx6qdl.dtsi \
 --------arch/arm/boot/dts/skeleton.dtsi \
 --------arch/arm/boot/dts/include/dt-bindings/gpio/gpio.h \
 arch/arm/boot/dts/imx6qdl-sabreauto.dtsi \
```

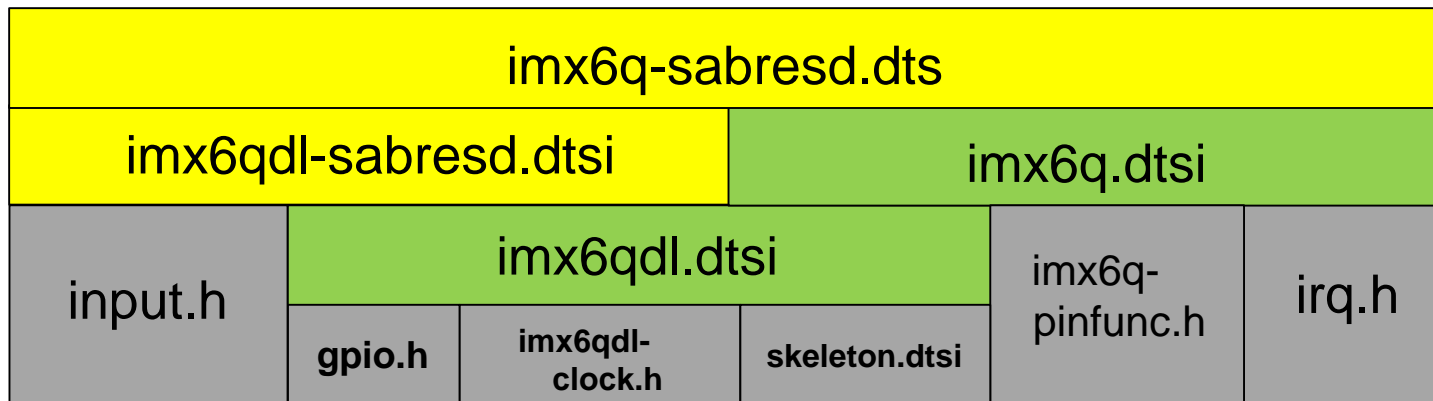| imx6dl-sabreauto.dts	
imx6qdl-sabreauto.dtsi	imx6dl.dtsi
imx6qdl.dtsi	imx6dl-pinfunc.h
gpio.h / skeleton.dtsi	

Device Tree Dependency (cont.)

L3.14.28_1.0.0 for mx6q-sabresd

arch/arm/boot/dts/.imx6q-sabresd.dtb.cmd:

```
deps_arch/arm/boot/dts/imx6q-sabresd.dtb := \
    arch/arm/boot/dts/imx6q.dtsi \
    ----arch/arm/boot/dts/include/dt-bindings/interrupt-controller/irq.h \
    ----arch/arm/boot/dts/imx6q-pinfunc.h \
    ----arch/arm/boot/dts/imx6qdl.dtsi \
    --------arch/arm/boot/dts/include/dt-bindings/clock/imx6qdl-clock.h \
    --------arch/arm/boot/dts/include/dt-bindings/gpio/gpio.h \
    --------arch/arm/boot/dts/skeleton.dtsi \
    arch/arm/boot/dts/imx6qdl-sabresd.dtsi \
    ----arch/arm/boot/dts/include/dt-bindings/input/input.h \
```
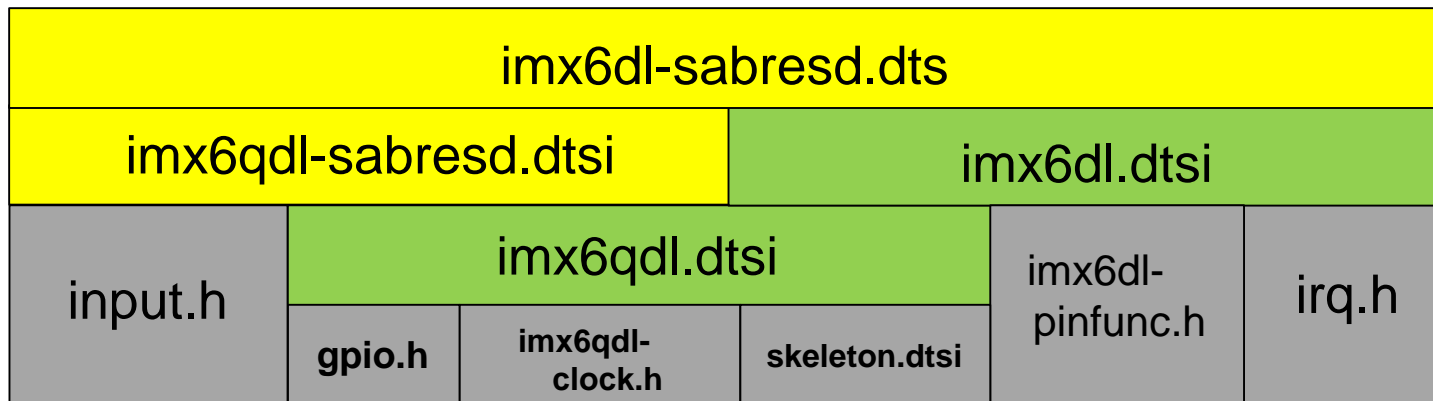
Device Tree Dependency (cont.)

L3.14.28_1.0.0 for mx6dl-sabresd

arch/arm/boot/dts/.imx6dl-sabresd.dtb.cmd:

```
deps_arch/arm/boot/dts/imx6dl-sabresd.dtb := \
  arch/arm/boot/dts/imx6dl.dtsi \
  ----arch/arm/boot/dts/include/dt-bindings/interrupt-controller/irq.h \
  ----arch/arm/boot/dts/imx6dl-pinfunc.h \
  ----arch/arm/boot/dts/imx6qdl.dtsi \
  --------arch/arm/boot/dts/include/dt-bindings/clock/imx6qdl-clock.h \
  --------arch/arm/boot/dts/include/dt-bindings/gpio/gpio.h \
  --------arch/arm/boot/dts/skeleton.dtsi \
  arch/arm/boot/dts/imx6qdl-sabresd.dtsi \
  ----arch/arm/boot/dts/include/dt-bindings/input/input.h \
```
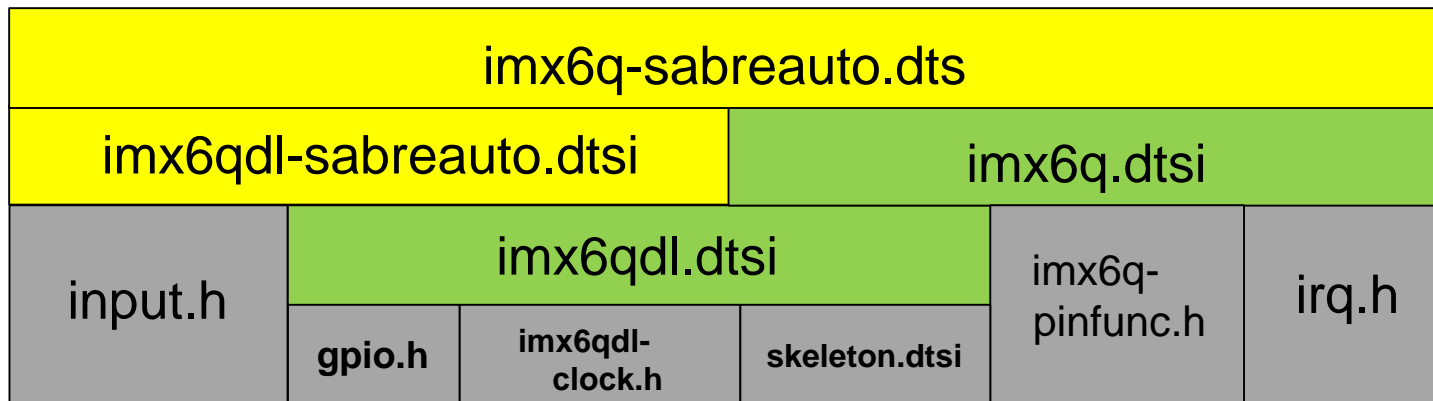
Device Tree Dependency (cont.)

L3.14.28_1.0.0 for mx6q-sabreauto

arch/arm/boot/dts/.imx6q-sabreauto.dtb.cmd:

```
deps_arch/arm/boot/dts/imx6q-sabreauto.dtb := \
 arch/arm/boot/dts/imx6q.dtsi \
 ----arch/arm/boot/dts/include/dt-bindings/interrupt-controller/irq.h \
 ----arch/arm/boot/dts/imx6q-pinfunc.h \
 ----arch/arm/boot/dts/imx6qdl.dtsi \
 --------arch/arm/boot/dts/include/dt-bindings/clock/imx6qdl-clock.h \
 --------arch/arm/boot/dts/include/dt-bindings/gpio/gpio.h \
 --------arch/arm/boot/dts/skeleton.dtsi \
 arch/arm/boot/dts/imx6qdl-sabreauto.dtsi \
 ----arch/arm/boot/dts/include/dt-bindings/input/input.h \
```
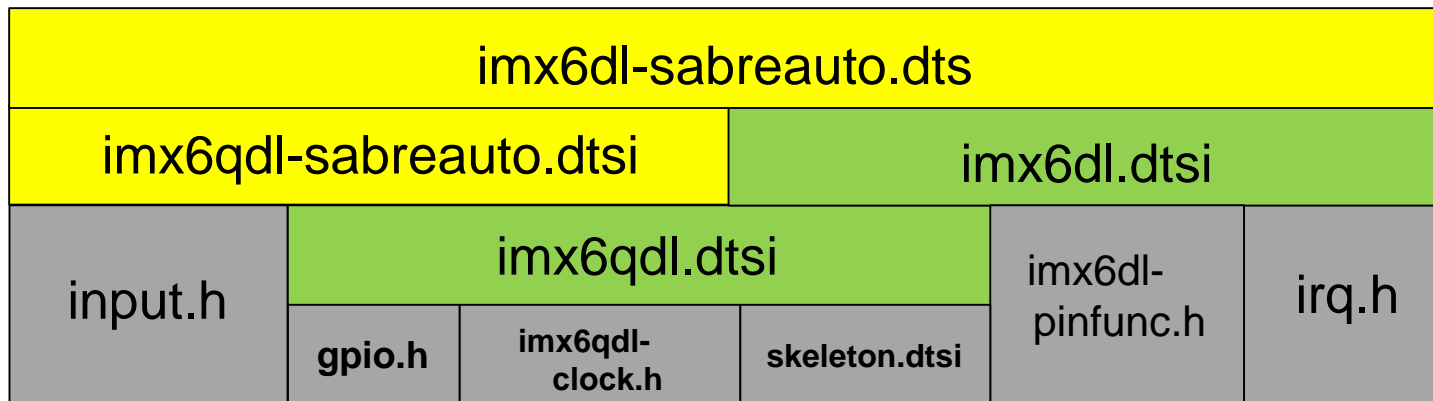
Device Tree Dependency (cont.)

L3.14.28_1.0.0 for mx6dl-sabreauto

arch/arm/boot/dts/.imx6dl-sabreauto.dtb.cmd:

```
deps_arch/arm/boot/dts/imx6dl-sabreauto.dtb := \
  arch/arm/boot/dts/imx6dl.dtsi \
  ----arch/arm/boot/dts/include/dt-bindings/interrupt-controller/irq.h \
  ----arch/arm/boot/dts/imx6dl-pinfunc.h \
  ----arch/arm/boot/dts/imx6qdl.dtsi \
  --------arch/arm/boot/dts/include/dt-bindings/clock/imx6qdl-clock.h \
  --------arch/arm/boot/dts/include/dt-bindings/gpio/gpio.h \
  --------arch/arm/boot/dts/skeleton.dtsi \
  arch/arm/boot/dts/imx6qdl-sabreauto.dtsi \
  --------arch/arm/boot/dts/include/dt-bindings/input/input.h \
```

Device Tree Tips

Device Status:

status = "okay"   --- The device with = "okay" will be matched

status = "disabled"   --- The device with = "disabled" will be ignored

usdhc1 is disabled

```
usdhc1: usdhc@02190000 {
     compatible = "fsl,imx6q-usdhc"; >;
     reg = <0x02190000 0x4000>;
     interrupts = <0 22 0x04>;
     clocks = <&clks 163>, <&clks 163>, <&clks 163>;
     clock-names = "ipg", "ahb", "per";
     bus-width = <4>;
     status = "disabled";
};
```

usbh1 is enabled

```
&usbh1 {
vbus-supply = <&reg_usb_h1_vbus>;
status = "okay";
}
```

Device Tree Tips (cont.)

The pinctl is mainly defined in imx6qdl-ottbox.dtsi, only a few defined in imx6q-ottbox.dts or imx6dl-ottbox.dts.

The macros are in the header files:

imx6dl-pinfunc.h imx6q-pinfunc.h imx6sl-pinfunc.h

Example:

```
uart1 {
        pinctrl_uart1_1: uart1grp-1 {
            fsl,pins = <
                MX6QDL_PAD_CSI0_DAT10__UART1_TX_DATA 0x1b0b1
                MX6QDL_PAD_CSI0_DAT11__UART1_RX_DATA 0x1b0b1
            >;
        };
    };

&uart1 {
    pinctrl-names = "default";
    pinctrl-0 = <&pinctrl_uart1_1>;
    status = "okay";
};
```

Here: MX6QDL_PAD_CSI0_DAT10__UART1_TX_DATA is function control.
        The value 0x1b0b1 is pad settings.

Device Tree Tips (cont.)

The last vaule of the property will be the final value.

Example:

usbh1

imx6qdl.dtsi

```
&usbh1 {
vbus-supply = <&reg_usb_h1_vbus>;
status = "okay";
}
```

The final value of **status** is **Disabled**

The final value of **vbus-supply** is **reg_usb_h1_vbus**

imx6qdl-sabresd.dtsi

```
&usbh1 {
vbus-supply = <&reg_usb_h1_vbus>;
status = "Disabled";
}
```

Device Tree Tips (cont.)

The include will merge the different properties together

imx6qdl.dtsi

```
usbotg {
            pinctrl_usbotg_1: usbotggrp-1 {
            ……………………..
            };
            pinctrl_usbotg_2: usbotggrp-2 {
            …………………
            };
 };
```

imx6qdl-ottbox.dtsi

```
&usbotg {
            pinctrl_usbotg_ottbox_1: usbotggrpottbox-1 {
            ……………………….
            } ;
};
```

Compiled DTB:

```
usbotg {
            pinctrl_usbotg_1: usbotggrp-1 {
            ……………………..
            };
            pinctrl_usbotg_2: usbotggrp-2 {
            …………………
            };
            pinctrl_usbotg_ottbox_1: usbotggrpottbox-1 {
            ……………………………
            } ;

};
```

Device Tree Tips (cont.)

How to check the dts error with so many includings

Once the dts is compiled, the dtb compiler will expand all the includings into one temporary dts file

You can check this file for including issues

Snatch:

/arch/arm/boot/dts/.imx6q-sabresd.dtb.dts.tmp

```
1836  };
1837  };
1838 };
1839 # 13 "arch/arm/boot/dts/imx6q.dtsi" 2
1840
1841 / {
1842  aliases {
1843   ipu1 = &ipu2;
1844  };
```

………………………………

…………………………

```
2760
2761 &vpu {
2762  pu-supply = <&pu_dummy>;
2763 };
2764 # 17 "arch/arm/boot/dts/imx6q-sabresd.dts" 2
2765
2766 / {
2767  model = "Freescale i.MX6 Quad SABRE Smart Device Board";
2768  compatible = "fsl,imx6q-sabresd", "fsl,imx6q";
2769 };
2770
```

Device Tree Tips (cont.)

The pinctrl conflicts

The linux kernel will print out the pinctrl(iomux) conflicts

Check and correct till no error

imx6q-pinctrl 20e0000.iomuxc: pin MX6Q_PAD_KEY_ROW0 already requested by 21f0000.serial; cannot claim for 2008000.ecspi

imx6q-pinctrl 20e0000.iomuxc: pin-127 (2008000.ecspi) status -22

imx6q-pinctrl 20e0000.iomuxc: could not request pin 127 on device 20e0000.iomuxc

spi_imx 2008000.ecspi: Error applying setting, reverse things back

Major changes in OTTBox – Power

- power vdd_arm and vdd_soc

imx6qdl-ottbox.dtsi:

```
&cpu0 {
    arm-supply = <&VDD_ARM_DCDC1>;
    soc-supply = <&VDD_SOC_DCDC2>;
};
```

Note: LDO is bypassed on OTTBox board due to overheat issue. See slide 17 for reference.

```
imx6qdl-ottbox.dtsi:
VDD_ARM_DCDC1: vddarm_dcdc1 {
        compatible = "regulator-fixed";
        regulator-name = "vddarm_dcdc1";
        enable-active-high;
};

VDD_SOC_DCDC2: vddsoc_dcdc2 {
        compatible = "regulator-fixed";
        regulator-name = "vddsoc_dcdc2";
        enable-active-high;
};
```

freescale™

Major changes in OTTBox – UART
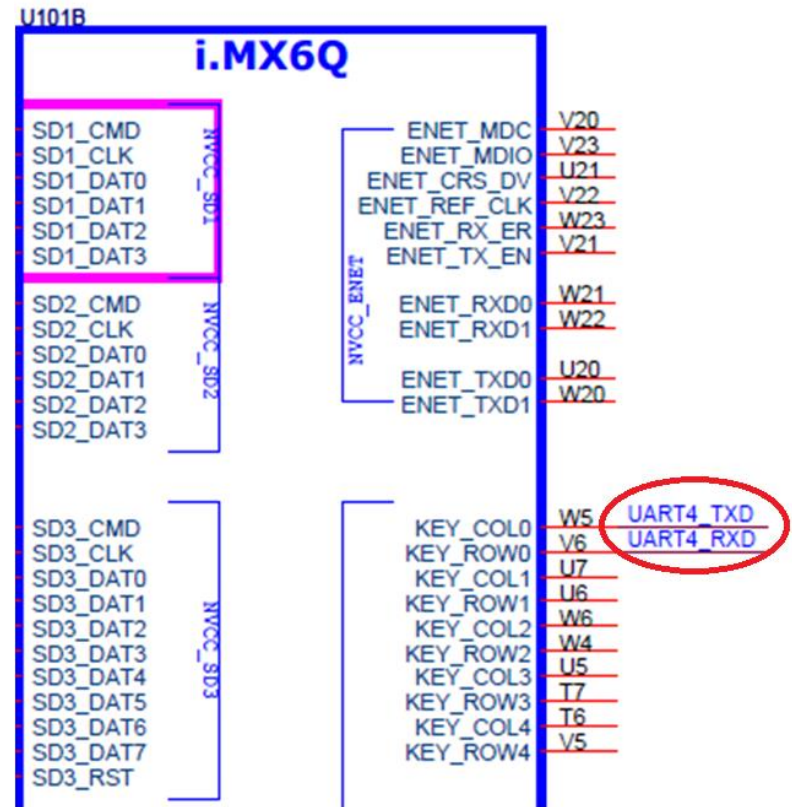
- uart

  enable uart 4 and disable all the others

imx6qdl-ottbox.dtsi:

```
&uart4 {
        pinctrl-names = "default";
        pinctrl-0 = <&pinctrl_uart4_1>;
        status = "okay";
};
```

imx6qdl-ottbox.dtsi:

```
pinctrl_uart4: uart4grp {
   fsl,pins = <
            MX6QDL_PAD_KEY_COL0__UART4_TX_DATA 0x1b0b1
            MX6QDL_PAD_KEY_ROW0__UART4_RX_DATA 0x1b0b1
   >;
};
```
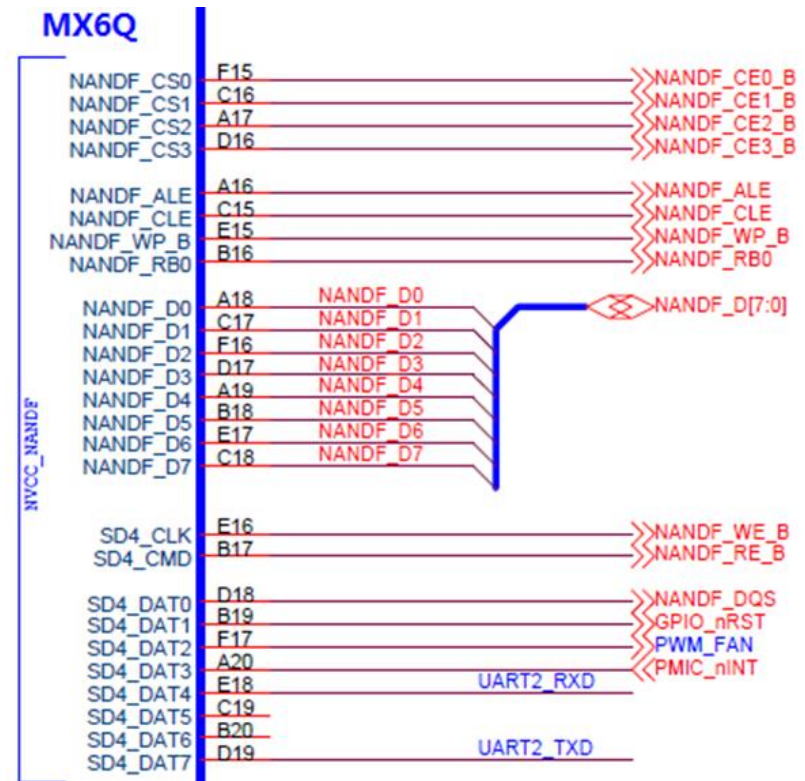
Major changes in OTTBox – NAND

- nand flash
- imx6qdl-ottbox.dtsi:

```
&gpmi {
  pinctrl-names = "default";
  pinctrl-0 = <&pinctrl_gpmi_nand_ottbox_1>;
  status = "okay"; /* pin conflict with uart3 */
};

pinctrl_gpmi_nand_ottbox_1: gpmi-nand-ottbox-1 {
  fsl,pins = <
          MX6QDL_PAD_NANDF_CS0__NAND_CE0_B   0xb0b1
          MX6QDL_PAD_NANDF_CS1__NAND_CE1_B   0xb0b1
          MX6QDL_PAD_NANDF_CS2__NAND_CE2_B   0xb0b1
          MX6QDL_PAD_NANDF_CS3__NAND_CE3_B   0xb0b1
          MX6QDL_PAD_NANDF_CLE__NAND_CLE     0xb0b1
          MX6QDL_PAD_NANDF_ALE__NAND_ALE     0xb0b1
          MX6QDL_PAD_NANDF_WP_B__NAND_WP_B   0xb0b1
          MX6QDL_PAD_NANDF_RB0__NAND_READY_B 0xb000
          MX6QDL_PAD_NANDF_D0__NAND_DATA00   0xb0b1
          MX6QDL_PAD_NANDF_D1__NAND_DATA01   0xb0b1
          MX6QDL_PAD_NANDF_D2__NAND_DATA02   0xb0b1
          MX6QDL_PAD_NANDF_D3__NAND_DATA03   0xb0b1
          MX6QDL_PAD_NANDF_D4__NAND_DATA04   0xb0b1
          MX6QDL_PAD_NANDF_D5__NAND_DATA05   0xb0b1
          MX6QDL_PAD_NANDF_D6__NAND_DATA06   0xb0b1
          MX6QDL_PAD_NANDF_D7__NAND_DATA07   0xb0b1
          >;
};
```

Major changes in OTTBox – Micro SD

- enable micro SD card (injected card)
- with card detection

imx6qdl-ottbox.dtsi:

```
&usdhc2 {
        pinctrl-names = "default";
        pinctrl-0 = <&pinctrl_usdhc2_ottbox_1>;
        no-1-8-v;
        keep-power-in-suspend;
        enable-sdio-wakeup;
        status = "okay";
};

pinctrl_usdhc2_ottbox_1: usdhc2grp-ottbox_1 {
    fsl,pins = <
                MX6QDL_PAD_SD2_CMD__SD2_CMD    0x17059
                MX6QDL_PAD_SD2_CLK__SD2_CLK    0x10059
                MX6QDL_PAD_SD2_DAT0__SD2_DATA0 0x17059
                MX6QDL_PAD_SD2_DAT1__SD2_DATA1 0x17059
                MX6QDL_PAD_SD2_DAT2__SD2_DATA2 0x17059
                MX6QDL_PAD_SD2_DAT3__SD2_DATA3 0x17059
                MX6QDL_PAD_GPIO_4__GPIO1_IO04  0x17059
                MX6QDL_PAD_KEY_ROW1__SD2_VSELECT 0x17059
    >;
};
```
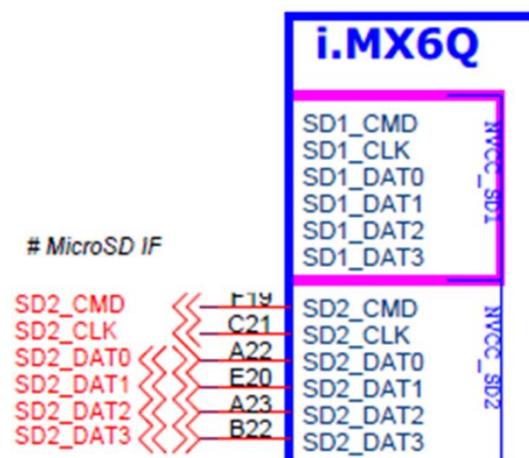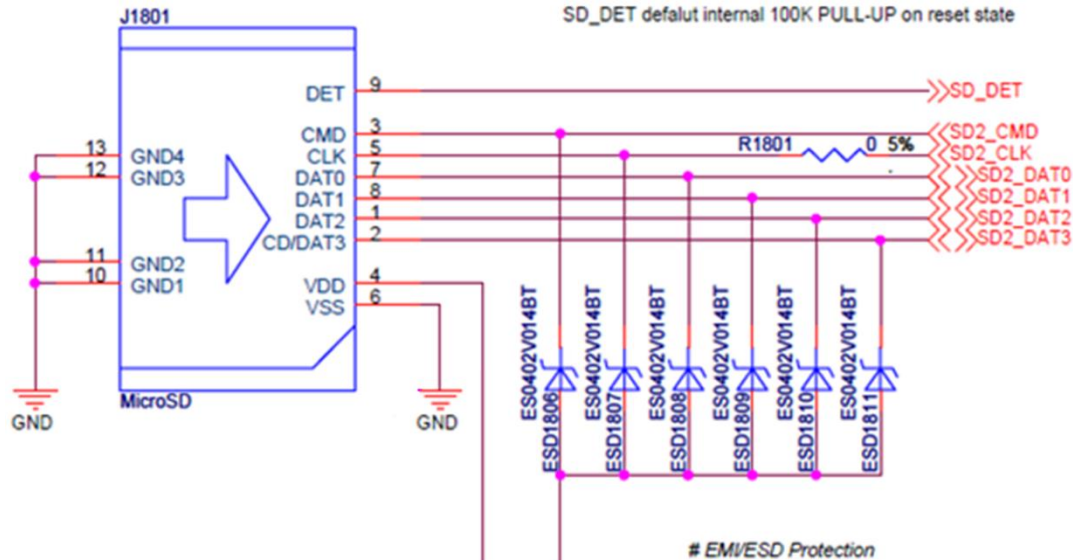
Major changes in OTTBox – USB OTG

- enable usb otg and usb host

usb otg

imx6qdl-ottbox.dtsi:

```
reg_usb_otg_vbus: usb_otg_vbus {
            compatible = "regulator-fixed";
            regulator-name = "usb_otg_vbus";
            regulator-min-microvolt = <5000000>;
            regulator-max-microvolt = <5000000>;
            gpio = <&gpio4 15 0>;
            enable-active-high;
     };


&usbotg {
    vbus-supply = <&reg_usb_otg_vbus>;
    pinctrl-names = "default";
    pinctrl-0 = <&pinctrl_usbotg_ottbox_1>;
    disable-over-current;
    status = "okay";
};


 pinctrl_usbotg_ottbox_1: usbotggrpottbox-1 {
            fsl,pins = <
                MX6QDL_PAD_GPIO_1__USB_OTG_ID  0x17059
                MX6QDL_PAD_KEY_ROW4__GPIO4_IO15  0x17059
            >;
       };
```
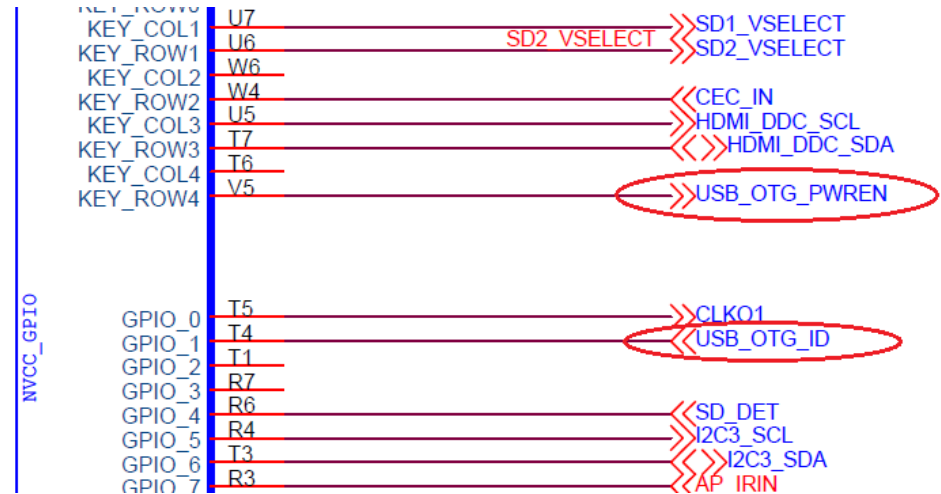
GPIO4_15:
Pad: KEY_ROW4
Function: USB_OTG_PWREN

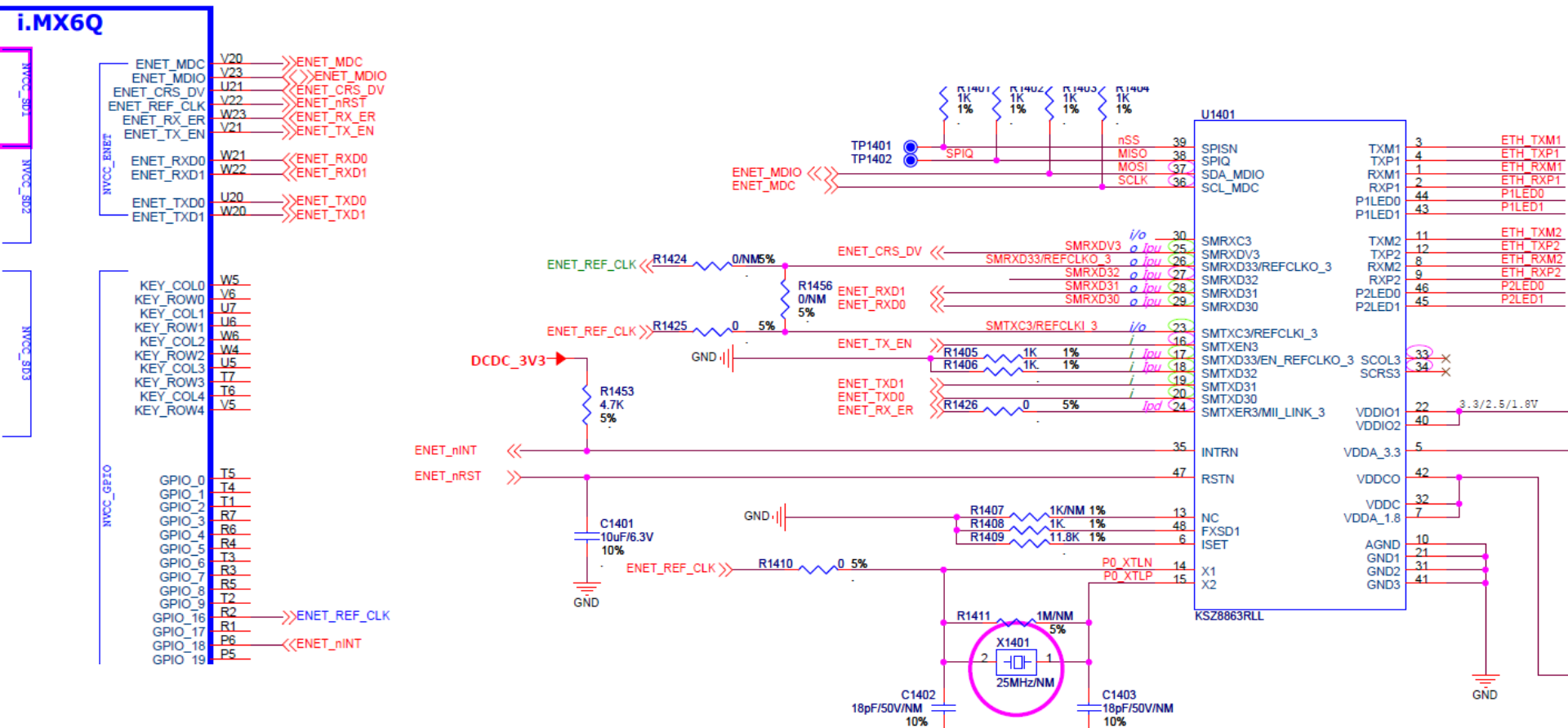**USB_OTG_ID:**
Pad: GPIO_1

usb host

```
&usbh1 {
        vbus-supply = <&reg_usb_h1_vbus>;
        status = "okay";
};
```

Major changes in OTTBox – Ethernet

Schematic: Ethernet

Major changes in OTTBox – Ethernet (cont.)

- enable fec (ethernet)

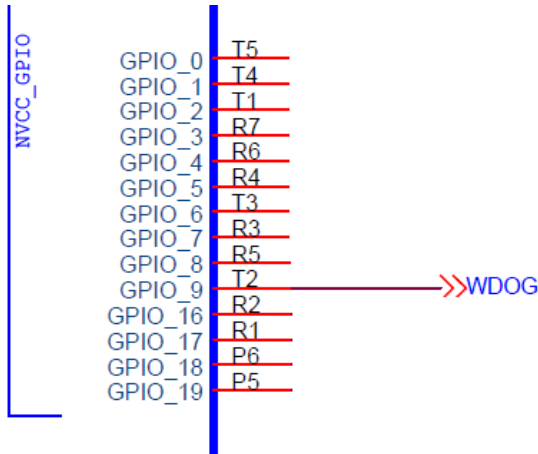imx6qdl-ottbox.dtsi:
```
&fec {
    pinctrl-names = "default";
    pinctrl-0 = <&pinctrl_enet_ottbox_1>;
    phy-mode = "rmii";
    phy-reset-gpios = <&gpio1 23 0>;
    phy-reset-duration = <5>;
    status = "okay";
};
```

```
                        pinctrl_enet_ottbox_1: enetgrp-ottbox_1{
                            fsl,pins = <
                                MX6QDL_PAD_ENET_MDIO__ENET_MDIO      0x1b0b0
                                MX6QDL_PAD_ENET_MDC__ENET_MDC        0x1b0b0
                                MX6QDL_PAD_ENET_CRS_DV__ENET_RX_EN   0x1b0b0
                                MX6QDL_PAD_ENET_RX_ER__ENET_RX_ER    0x1b0b0
                                MX6QDL_PAD_ENET_TX_EN__ENET_TX_EN    0x1b0b0
                                MX6QDL_PAD_ENET_RXD0__ENET_RX_DATA0  0x1b0b0
                                MX6QDL_PAD_ENET_RXD1__ENET_RX_DATA1  0x1b0b0
                                MX6QDL_PAD_ENET_TXD0__ENET_TX_DATA0  0x1b0b0
                                MX6QDL_PAD_ENET_TXD1__ENET_TX_DATA1  0x1b0b0
                                MX6QDL_PAD_GPIO_16__ENET_REF_CLK     0x4001b0a8
                                MX6QDL_PAD_ENET_REF_CLK__GPIO1_IO23  0x1b0b0
                                MX6QDL_PAD_GPIO_18__GPIO7_IO13       0x1b0b0
                            >;
                        };
```

Major changes in OTTBox – WDOG

- Watchdog1 is used in OTTBox, select is in device tree

imx6qdl-ottbox.dtsi:

&gpc {
    /* use ldo-bypass, u-boot will check it and configure */
    fsl,ldo-bypass = <1>;
    fsl,wdog-reset = <1>;
};

R7	GPIO03	NVCC_GPIO	ALT5	esai.ESAI_RX_HF_CLK		i2c3.I2C3_SCL
R6	GPIO04	NVCC_GPIO	ALT5	esai.ESAI_TX_HF_CLK		kpp.KEY_COL7
R4	GPIO05	NVCC_GPIO	ALT5	esai.ESAI_TX2_RX3		kpp.KEY_ROW7
T3	GPIO06	NVCC_GPIO	ALT5	esai.ESAI_TX_CLK		i2c3.I2C3_SDA
R3	GPIO07	NVCC_GPIO	ALT5	esai.ESAI_TX4_RX1	ecspi5.ECSPI5_RDY	epit1.EPIT1_OUT
R5	GPIO08	NVCC_GPIO	ALT5	esai.ESAI_TX5_RX0	xtalosc.XTALOSC_REF_CLK_32K	epit2.EPIT2_OUT
T2	GPIO09	NVCC_GPIO	ALT5	esai.ESAI_RX_FS	wdog1.WDOG1_B	kpp.KEY_COL6
R2	GPIO16	NVCC_GPIO	ALT5	esai.ESAI_TX3_RX2	enet.ENET_1588_EVENT2_IN	enet.ENET_REF_CLK
R1	GPIO17	NVCC_GPIO	ALT5	esai.ESAI_TX0	enet.ENET_1588_EVENT3_IN	ccm.CCM_PMIC_READY
P6	GPIO18	NVCC_GPIO	ALT5	esai.ESAI_TX1	enet.ENET_RX_CLK	usdhc3.SD3_VSELECT
P5	GPIO19	NVCC_GPIO	ALT5	kpp.KEY_COL5	enet.ENET_1588_EVENT0_OUT	spdif.SPDIF_OUT

OTTBox: MX6Q & MX6DL difference

- eMMC on mx6q board layout overlaps with micro SD on mx6dl board
- so settings for them could NOT be placed in imx6qdl-ottbox.dtsi.
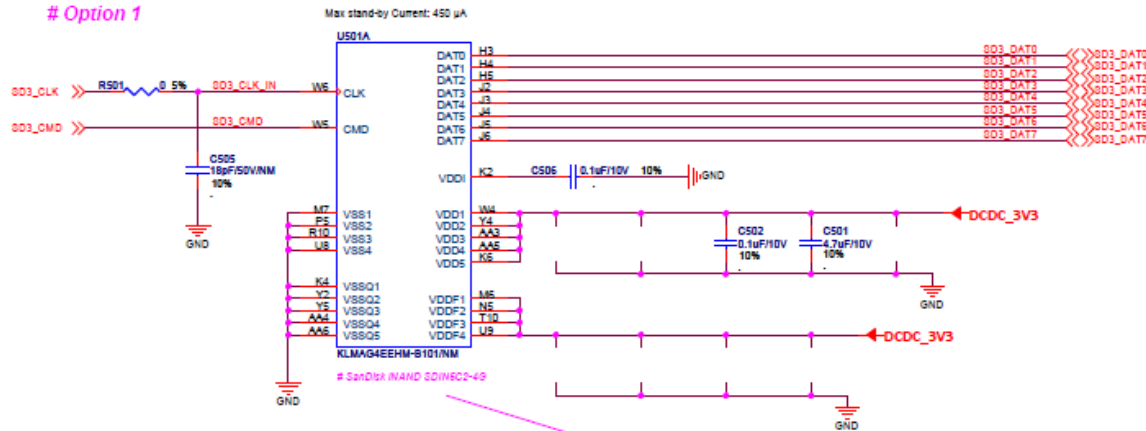
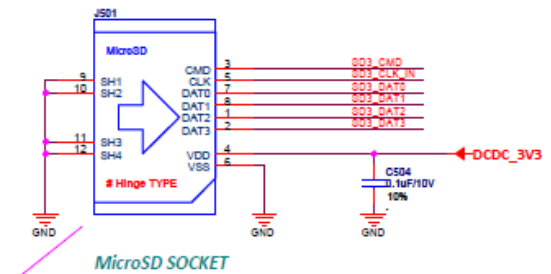# OTTBox: MX6Q & MX6DL difference – eMMC on MX6Q

- Micro SD for mx6dl board layout overlaps with eMMC for mx6q board: no card detection

- For **eMMC** on **mx6q** board:

imx6q-ottbox.dts:
```
&usdhc3 {
        pinctrl-names = "default";
        pinctrl-0 = <&pinctrl_usdhc3>;
        bus-width = <8>;
        non-removable;
        no-1-8-v;
        keep-power-in-suspend;
        status = "okay";
};
```

imx6q-ottbox.dts:
```
pinctrl_usdhc3: usdhc3grp {
        fsl,pins = <
                MX6QDL_PAD_SD3_CMD__SD3_CMD        0x17059
                MX6QDL_PAD_SD3_CLK__SD3_CLK        0x10059
                MX6QDL_PAD_SD3_DAT0__SD3_DATA0     0x17059
                MX6QDL_PAD_SD3_DAT1__SD3_DATA1     0x17059
                MX6QDL_PAD_SD3_DAT2__SD3_DATA2     0x17059
                MX6QDL_PAD_SD3_DAT3__SD3_DATA3     0x17059
                MX6QDL_PAD_SD3_DAT4__SD3_DATA4     0x17059
                MX6QDL_PAD_SD3_DAT5__SD3_DATA5     0x17059
                MX6QDL_PAD_SD3_DAT6__SD3_DATA6     0x17059
                MX6QDL_PAD_SD3_DAT7__SD3_DATA7     0x17059
        >;
};
```
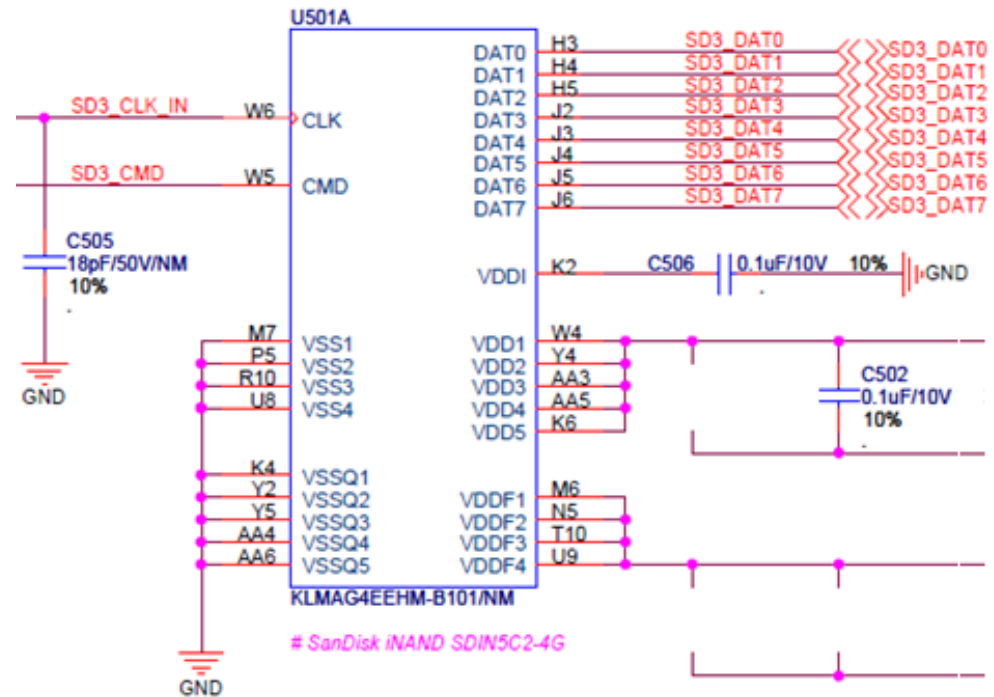
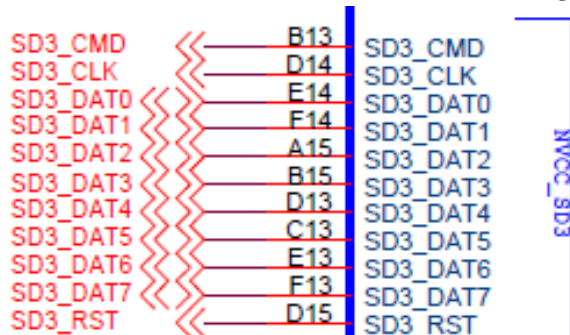# OTTBox: MX6Q & MX6DL difference – Micro SD on MX6DL

- Micro SD for mx6dl board layout overlaps with eMMC for mx6q board: no card detection

- For **micro SD card** on **mx6dl** board:

imx6dl-ottbox.dts:
```
&usdhc3 {
        pinctrl-names = "default";
        pinctrl-0 = <&pinctrl_usdhc3_2>;
        bus-width = <4>;
        non-removable;
        no-1-8-v;
        keep-power-in-suspend;
        status = "okay";
};
```
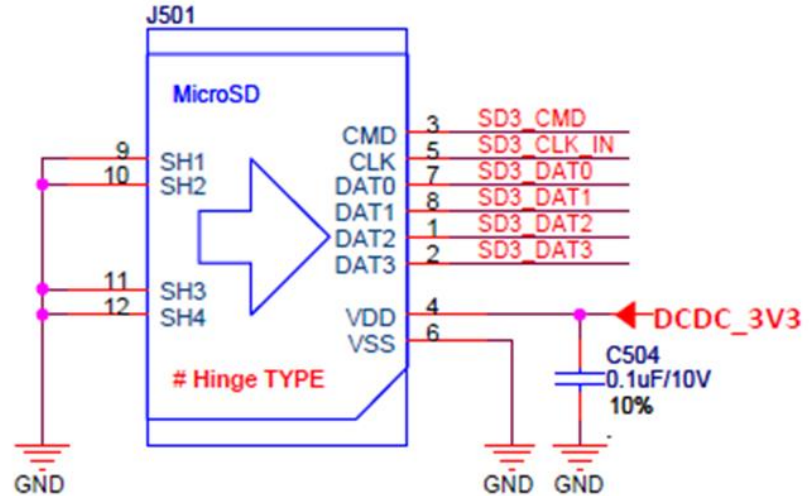
imx6dl-ottbox.dts:
```
pinctrl_usdhc3_2: usdhc3grp -2{
        fsl,pins = <
                MX6QDL_PAD_SD3_CMD__SD3_CMD      0x17059
                MX6QDL_PAD_SD3_CLK__SD3_CLK      0x10059
                MX6QDL_PAD_SD3_DAT0__SD3_DATA0   0x17059
                MX6QDL_PAD_SD3_DAT1__SD3_DATA1   0x17059
                MX6QDL_PAD_SD3_DAT2__SD3_DATA2   0x17059
                MX6QDL_PAD_SD3_DAT3__SD3_DATA3   0x17059
        >;
};
```
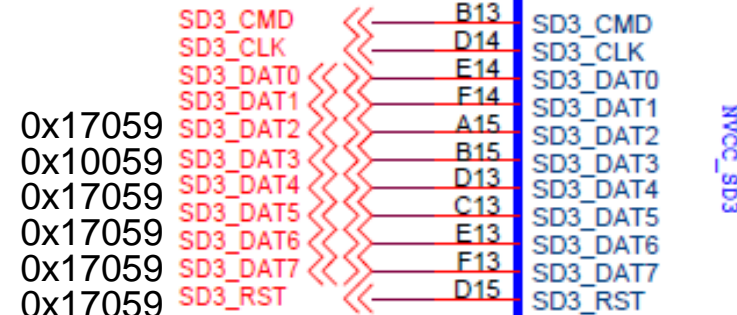
Agenda

- **Source Codes Changes**
  - ➤ **U-boot**
  - ➤ **Linux Kernel**
  - ➤ **Device Tree**

- **Yocto Project Modification**

- **Image Building Instructions**

- **QA**

Yocto Modification

add a layer (mylayer) for:

1. u-boot and kernel patching
2. support new machines (…)
3. appoint new defconfig file:

$$imx\_v7\_ottbox\_defconfig$$

yocto-layer create mylayer

We could run this command to create our new-add layer under directory sources/

mylayer directory structure

- glance at the added layer (mylayer) under directory sources/

```
meta-mylayer/
├── conf
│   ├── layer.conf
│   └── machine
│       ├── imx6dlottbox_mmc.conf
│       ├── imx6dlottbox_nand.conf
│       ├── imx6qottbox_emmc.conf
│       └── imx6qottbox_nand.conf
└── recipes-bsp
    ├── linux
    │   ├── linux-imx
    │   │   └── 0001-add-support-for-OTTBox.patch
    │   ├── linux-imx _%.bbappend
    │   └── linux-imx-mfgtool_%.bbappend
    └── u-boot
        ├── u-boot-imx
        │   └── 0001-add-support-for-OTTBox.patch
        ├── u-boot-imx _%.bbappend
        └── u-boot-imx-mfgtool_%.bbappend
```

freescale ™

yocto-layer create mylayer

yocto-layer command is activated after we run:

source fsl-setup-release.sh

yocto-layer create mylayer

if all setting use default value, there will no example recipe and no bbappend, and the created layer looks like below:

```
meta-mylayer/
        ├───── conf
        │      └───── layer.conf
        ├───── COPYING.MIT
        └───── README
```

yocto-layer create mylayer (cont.)

layer.conf

```
# We have a conf and classes directory, add to BBPATH
BBPATH .= ":${LAYERDIR}"

# We have recipes-* directories, add to BBFILES
BBFILES += "${LAYERDIR}/recipes-*/*/*.bb \
      ${LAYERDIR}/recipes-*/*/*.bbappend"

BBFILE_COLLECTIONS += "meta-mylayer"
BBFILE_PATTERN_meta-mylayer = "^${LAYERDIR}/"
BBFILE_PRIORITY_meta-mylayer = "6"
```

freescale ™

bb/bbappend file location study

```
meta-mylayer/
├──── conf
│     ├── layer.conf
│     ├── hello1.bb
│     └── aaa
│         └── hello2.bb
├── hello3.bb
├── bbb
│   └── hello4.bb
└── recipes-bsp
    ├── hello5.bb
    └── linux
        ├── linux-imx
        │   └── 0001-add-support-for-OTTBox.patch
        ├── linux-imx _%.bbappend
        └── hello6.bb
```

Only bitbake hello6 works!

bb/bbappend file location study (cont.)

./meta-qt5/recipes-qt/examples/qt5everywheredemo_1.0.bb
./meta-qt5/recipes-qt/examples/quitindicators_1.0.1.bb
./meta-qt5/recipes-qt/tufao/tufao_1.2.1.bb

./meta-qt5/recipes-devtools/ninja/ninja-native_1.4.0.bb

| recipes-*/*/*.bb |

./meta-fsl-arm-extra/recipes-kernel/linux/linux-cfa_3.10.bb
./meta-fsl-arm-extra/recipes-kernel/linux/linux-cubox-i_3.14.14.bb
./meta-fsl-arm-extra/recipes-kernel/linux/linux-wandboard_3.10.17.bb
./meta-fsl-arm-extra/recipes-kernel/linux/linux-cfa_3.12.bb
./meta-fsl-arm-extra/recipes-kernel/linux/linux-congatec-rt_3.10.17.bb
./meta-fsl-arm-extra/recipes-bsp/broadcom-nvram-config/bcm4329-nvram-config.bb
./meta-fsl-arm-extra/recipes-bsp/u-boot/u-boot-cubox-i_2013.10.bb
./meta-fsl-arm-extra/recipes-bsp/u-boot/u-boot-timesys_2011.12.bb
./meta-fsl-arm-extra/recipes-bsp/u-boot/u-boot-boundary_git.bb
./meta-fsl-arm-extra/recipes-bsp/u-boot/u-boot-script-boundary_git.bb
./meta-fsl-arm-extra/recipes-bsp/u-boot/u-boot-congatec_2013.04.bb
./meta-fsl-arm-extra/recipes-core/net-persistent-mac/net-persistent-mac.bb
./meta-openembedded/meta-python/recipes-devtools/python/python-feedparser_5.1.3.bb
./meta-openembedded/meta-python/recipes-devtools/python/python-pyparsing_2.0.1.bb
./meta-openembedded/meta-python/recipes-devtools/python/python-psutil_0.6.1.bb
./meta-openembedded/meta-python/recipes-devtools/python/python-pep8_1.4.6.bb
./meta-openembedded/meta-python/recipes-devtools/python/python-cheetah_2.4.4.bb
./meta-openembedded/meta-python/recipes-devtools/python/python-lxml_3.0.2.bb

freescale™

bb/bbappend file location study (cont.)

layer.conf
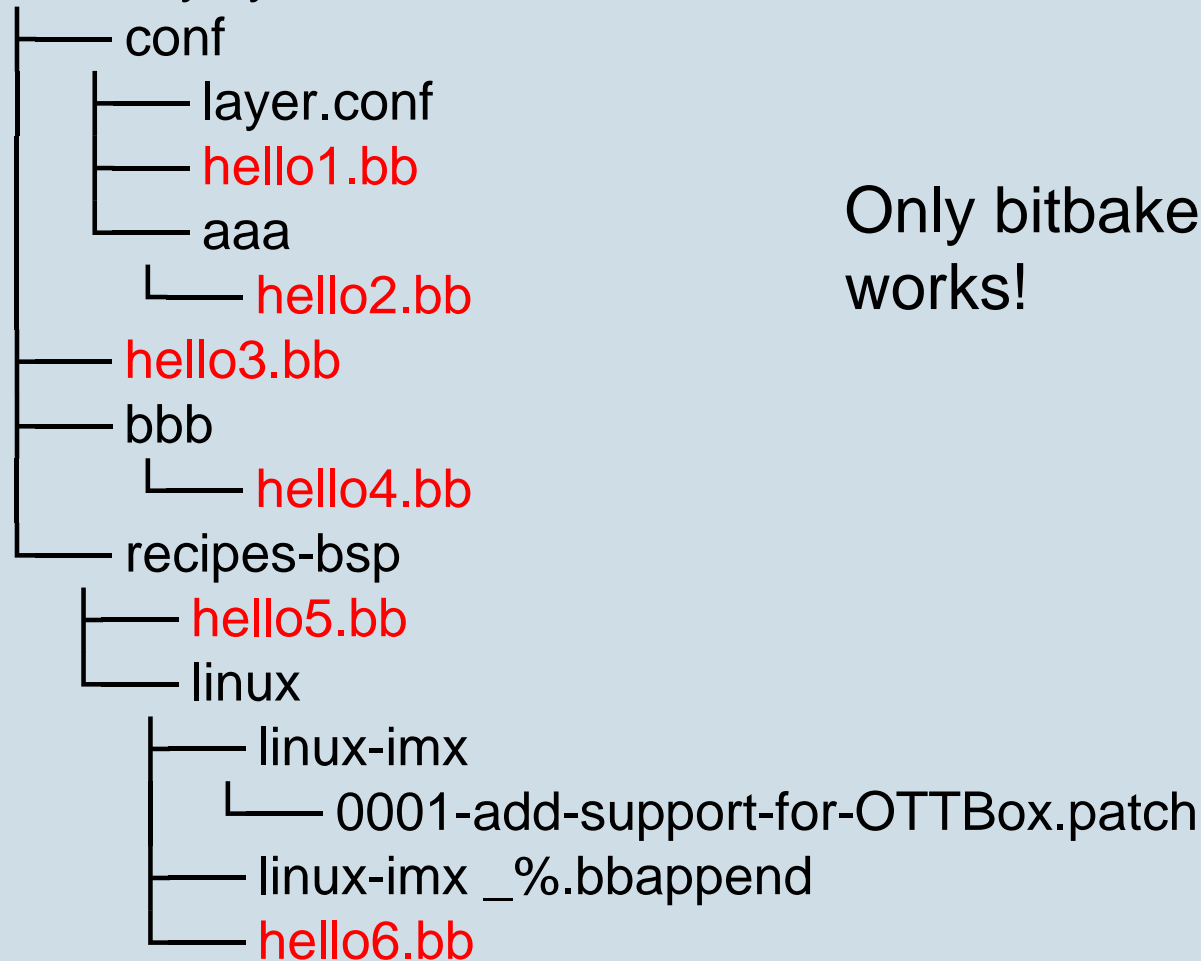
```
# We have a conf and classes directory, add to BBPATH
BBPATH .= ":${LAYERDIR}"

# We have recipes-* directories, add to BBFILES
BBFILES += "${LAYERDIR}/recipes-*/*/*.bb \
        ${LAYERDIR}/recipes-*/*/*.bbappend"

BBFILE_COLLECTIONS += "meta-mylayer"
BBFILE_PATTERN_meta-mylayer = "^${LAYERDIR}/"
BBFILE_PRIORITY_meta-mylayer = "6"
```

Search bb and bbappend files in the BBFILES directories.

bb/bbappend file location study (cont.)

layer.conf

```
# We have a conf and classes directory, add to BBPATH
BBPATH .= ":${LAYERDIR}"

# We have recipes-* directories, add to BBFILES
BBFILES += "${LAYERDIR}/recipes-*/*/*.bb \
    ${LAYERDIR}/*.bb \
    ${LAYERDIR}/*/*.bb \
    ${LAYERDIR}/*/*/*.bb \
    ${LAYERDIR}/recipes-*/*/*.bbappend"

BBFILE_COLLECTIONS += "meta-mylayer"
BBFILE_PATTERN_meta-mylayer = "^${LAYERDIR}/"
BBFILE_PRIORITY_meta-mylayer = "6"
```

Now we could bitbake all hello1 -> hello6.

freescale ™

yocto-layer create mylayer (cont.)

yocto-layer create mylayer

if we create layer with
sample recipe and
sample bbappend, the
created layer looks
like this:

```
meta-mylayer/
├── conf
│   └── layer.conf
├── COPYING.MIT
├── README
├── recipes-example
│   └── example
│       ├── example-0.1
│       │   ├── example.patch
│       │   └── helloworld.c
│       └── example_0.1.bb
└── recipes-example-bbappend
    └── example-bbappend
        ├── example-0.1
        │   └── example.patch
        └── example_0.1.bbappend
```

yocto-layer create mylayer (cont.)

example_0.1.bb

```
#
# This file was derived from the 'Hello World!' example recipe in the
# Yocto Project Development Manual.
#

DESCRIPTION = "Simple helloworld application"
SECTION = "examples"
LICENSE = "MIT"
LIC_FILES_CHKSUM =
"file://${COMMON_LICENSE_DIR}/MIT;md5=0835ade698e0bcf8506ecda2f7b4f302"
PR = "r0"

SRC_URI = "file://helloworld.c"

S = "${WORKDIR}"

do_compile() {
        ${CC} helloworld.c -o helloworld
}

do_install() {
        install -d ${D}${bindir}
        install -m 0755 helloworld ${D}${bindir}
}
```

freescale™

yocto-layer create mylayer (cont.)

example_0.1.bbappend

```
FILESEXTRAPATHS_prepend := "${THISDIR}/${PN}-${PV}:"

#
# This .bbappend doesn't yet do anything - replace this text with
# modifications to the example_0.1.bb recipe, or whatever recipe it is
# that you want to modify with this .bbappend (make sure you change
# the recipe name (PN) and version (PV) to match).
#
```

```
└─recipes-example-bbappend
   └─ example-bbappend
      ├─ example-0.1
      │  └─ example.patch
      └─ example_0.1.bbappend
```

mylayer directory structure

- add a layer (mylayer) under directory sources/

```
meta-mylayer/
├────── conf
│       ├────── layer.conf
│       └────── machine
│               ├────── imx6dlottbox_mmc.conf
│               ├────── imx6dlottbox_nand.conf
│               ├────── imx6qottbox_emmc.conf
│               └────── imx6qottbox_nand.conf
└────── recipes-bsp
        ├────── linux
        │       ├────── linux-imx
        │       │       └────── 0001-add-support-for-OTTBox.patch
        │       ├────── linux-imx _%.bbappend
        │       └────── linux-imx-mfgtool_%.bbappend
        └────── u-boot
                ├────── u-boot-imx
                │       └────── 0001-add-support-for-OTTBox.patch
                ├────── u-boot-imx _%.bbappend
                └────── u-boot-imx-mfgtool_%.bbappend
```
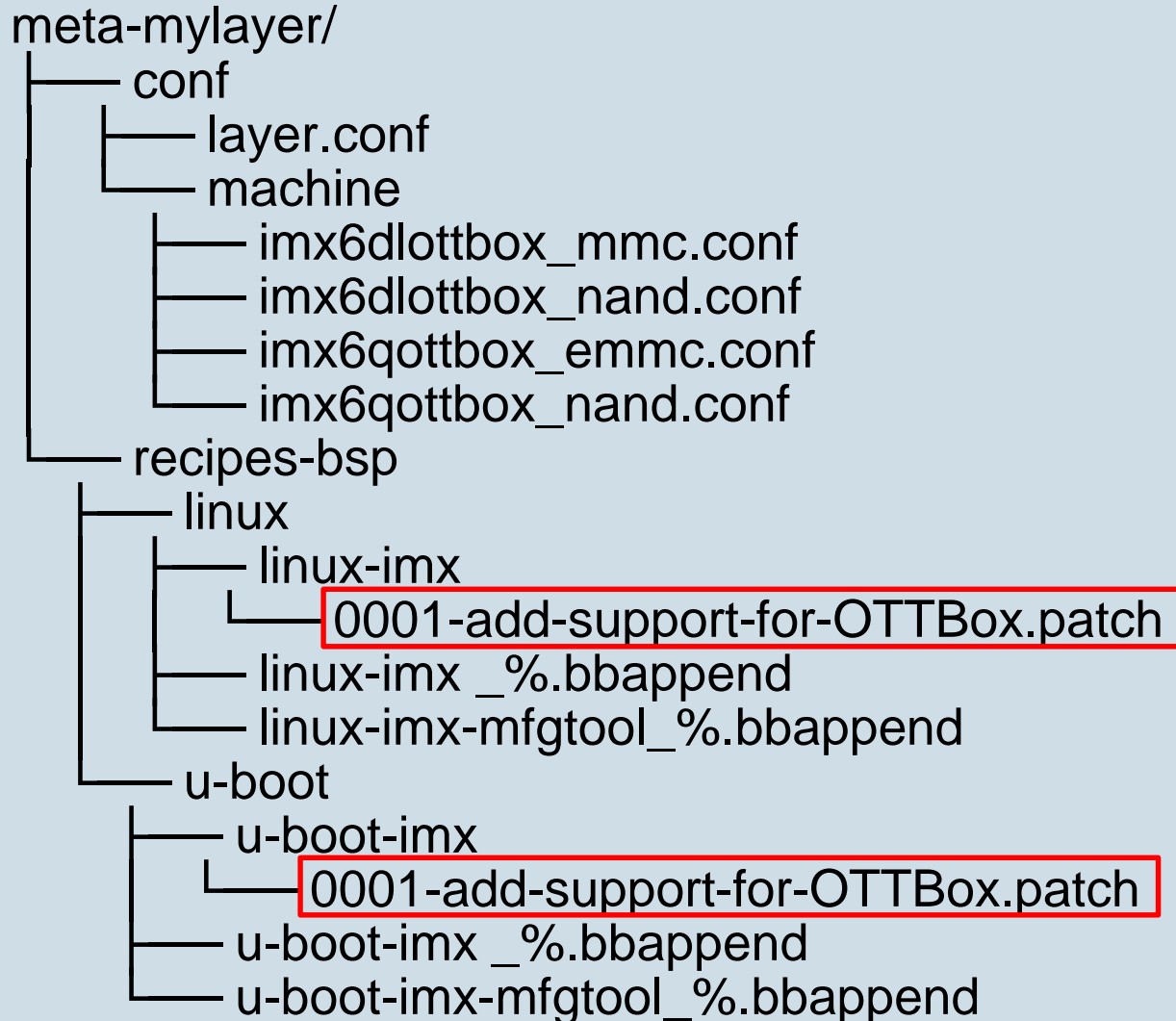
1, u-boot and kernel patching

- layer.conf:

```
# We have a conf and classes directory, add to BBPATH
BBPATH .= ":${LAYERDIR}"


# We have recipes-* directories, add to BBFILES
BBFILES += "${LAYERDIR}/recipes-*/*/*.bb \
        ${LAYERDIR}/recipes-*/*/*.bbappend"

BBFILE_COLLECTIONS += "mylayer"
BBFILE_PATTERN_mylayer = "^${LAYERDIR}/"
BBFILE_PRIORITY_mylayer = "5"
```

This file is created manually.

1, u-boot and kernel patching (cont.)

- u-boot-imx_%.bbappend:

```
FILESEXTRAPATHS_prepend := "${THISDIR}/${PN}:"

SRC_URI += "file://0001-add-support-for-OTTBox.patch"
```

- u-boot-imx-mfgtool_%.bbappend:

```
FILESEXTRAPATHS_prepend := "${THISDIR}/u-boot-imx:"

SRC_URI += "file://0001-add-support-for-OTTBox.patch"
```

1, u-boot and kernel patching (cont.)

- linux-imx_%.bbappend:

```
FILESEXTRAPATHS_prepend := "${THISDIR}/${PN}:"

SRC_URI += "file://0001-add-support-for-OTTBox.patch"

...
```

- if file name is *linux-imx_ 3.14.28.bbappend*, it also works as the preferred linux-imx version is 3.14.28. But suppose we bitbake *linux-imx_3.10.54.bb*, this patch will not be appended.

- we could add more than one patch here.

1, u-boot and kernel patching (cont.)

- linux-imx_%.bbappend:

```
FILESEXTRAPATHS_prepend := "${THISDIR}/${PN}:"

SRC_URI += "file://0001-add-support-for-OTTBox.patch"
…
```
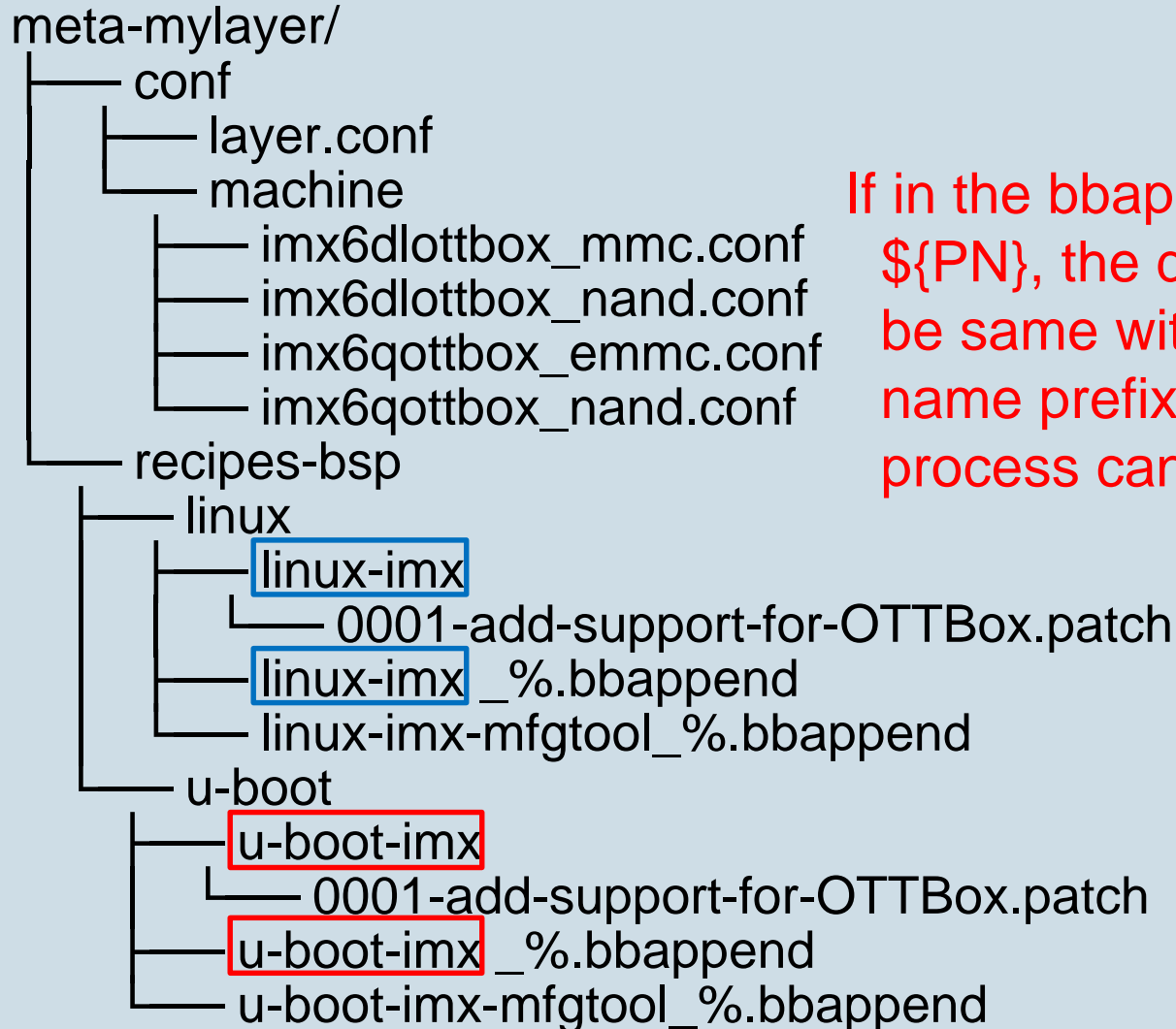
- linux-imx-mfgtool_%.bbappend:

```
FILESEXTRAPATHS_prepend := "${THISDIR}/linux-imx:"

SRC_URI += "file://0001-add-support-for-OTTBox.patch"
…
```

1, u-boot and kernel patching (cont.)

- add a layer (mylayer) under directory sources/

```
meta-mylayer/
├──── conf
│     ├──── layer.conf
│     └──── machine
│           ├──── imx6dlottbox_mmc.conf
│           ├──── imx6dlottbox_nand.conf
│           ├──── imx6qottbox_emmc.conf
│           └──── imx6qottbox_nand.conf
├──── recipes-bsp
│     ├──── linux
│     │     ├──── linux-imx
│     │     │     └──── 0001-add-support-for-OTTBox.patch
│     │     ├──── linux-imx _%.bbappend
│     │     └──── linux-imx-mfgtool_%.bbappend
│     └──── u-boot
│           ├──── u-boot-imx
│           │     └──── 0001-add-support-for-OTTBox.patch
│           ├──── u-boot-imx _%.bbappend
│           └──── u-boot-imx-mfgtool_%.bbappend
```
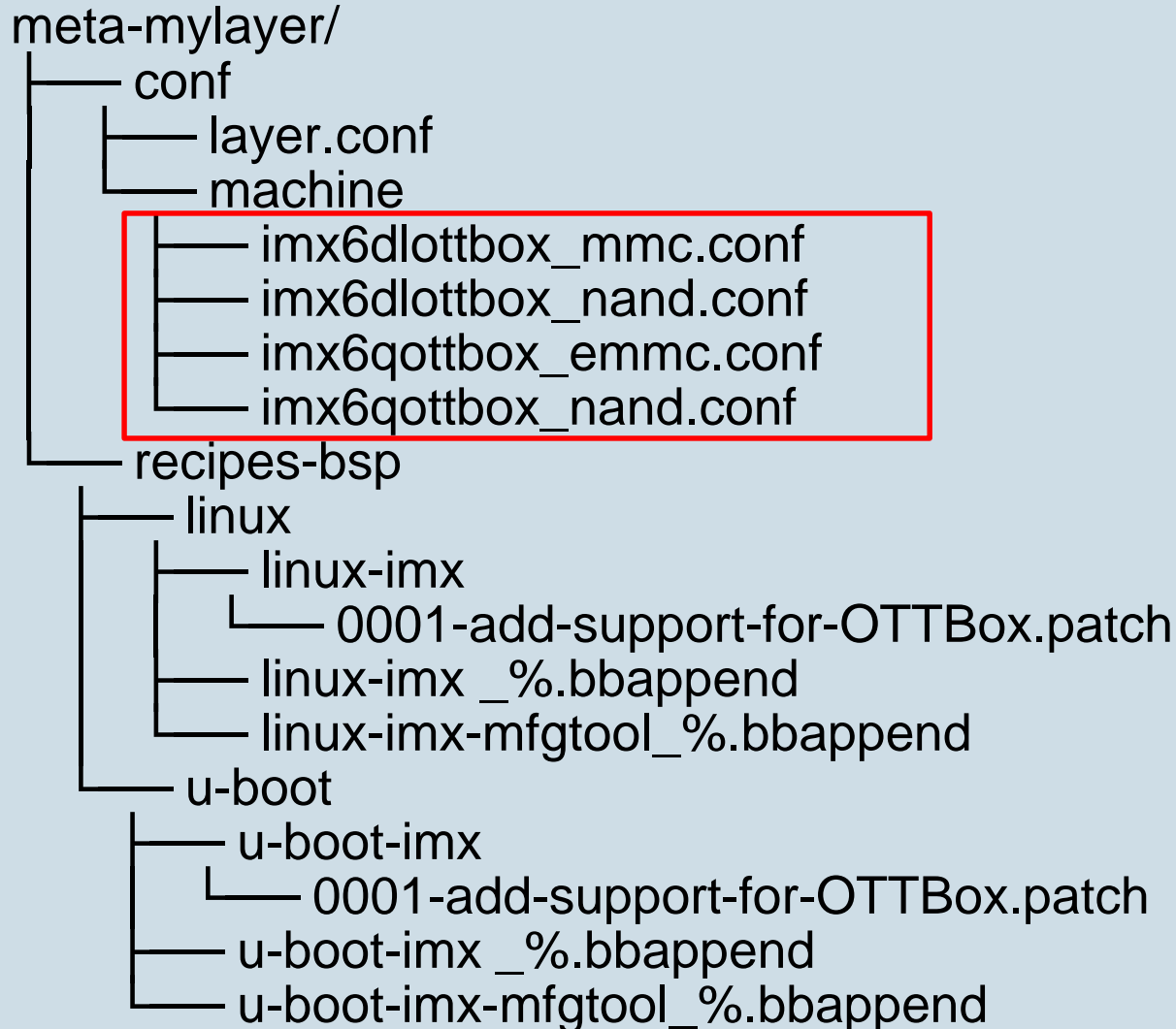
If in the bbappend file, the dir use ${PN}, the directory name should be same with the bbappend file name prefix. Or, the bitbake process cannot get the patch file.

2, support new machines

- add a layer (mylayer) under directory sources/

```
meta-mylayer/
├─── conf
│    ├─── layer.conf
│    └─── machine
│         ├─── imx6dlottbox_mmc.conf
│         ├─── imx6dlottbox_nand.conf
│         ├─── imx6qottbox_emmc.conf
│         └─── imx6qottbox_nand.conf
├─── recipes-bsp
│    ├─── linux
│    │    ├─── linux-imx
│    │    │    └─── 0001-add-support-for-OTTBox.patch
│    │    ├─── linux-imx _%.bbappend
│    │    └─── linux-imx-mfgtool_%.bbappend
│    └─── u-boot
│         ├─── u-boot-imx
│         │    └─── 0001-add-support-for-OTTBox.patch
│         ├─── u-boot-imx _%.bbappend
│         └─── u-boot-imx-mfgtool_%.bbappend
```

freescale ™

2, support new machines (cont.)

Imx6qottbox_nand.conf:

Kernel image type, default uImage

Device tree to build

config uboot, could be modified in build/conf/local.conf

```
…

require conf/machine/include/imx6sabresd-common.inc

SOC_FAMILY = "mx6:mx6q"
KERNEL_IMAGETYPE = "zImage"
KERNEL_DEVICETREE = "imx6q-ottbox.dtb"

UBOOT_CONFIG ??= "nand"
UBOOT_CONFIG[nand] = "mx6qottbox_config"
UBOOT_CONFIG[emmc] = "mx6qottbox_emmcrootfs_config"
UBOOT_CONFIG[mfgtool] = "mx6qottbox_config"
```

freescale ™

3, appoint new defconfig file

- *linux-imx_3.14.28.bb* has defined below function:

```
…
do_configure_prepend() {
# copy latest defconfig for imx_v7_defconfig  to use
  cp ${S}/arch/arm/configs/imx_v7_defconfig  ${S}/.config
  cp ${S}/arch/arm/configs/imx_v7_defconfig  ${S}/../defconfig
fi
}
```

- however, OTTBox use imx_v7_ottbox_defconfig instead of imx_v7_defconfig due to the specific HW configuration (see next page).

freescale ™

3, appoint new defconfig file (cont.)

• Why we need new defconfig:

On mx6q sabresd board there is max11801 for touch screen.   OTTBox board has no such component.   So in the kernel the serial console will keep printing below:

FAIL max11801_client not initialize
or
max11801_ts 1-0048: FIFO_RD_AUX_MSB read fails

Besides, the release BSP original imx_v7_defconfig has incorporated almost all probably needed drivers, like SCSI, SPI-NOR, digital accelermeter, proximity/opto sensor, ambient light sensor… For PMIC, several vendor's PMIC drivers including PFUSE100 are built into the kernel. Actually on OTTBox board none of them are used.

So, we reconfigured base on the imx_v7_defconfig for OTTBox board, which is imx_v7_ottbox_defconfig.

3, appoint new defconfig file (cont.)

- in *linux-imx_%.bbappend* add below:

```
…
do_configure_append() {
if [ "${MACHINE}" = "imx6dlottbox" ] || [ "${MACHINE}" =
"imx6qottbox" ]  ; then
   # copy latest defconfig for imx_v7_ottbox_defconfig  to use
   cp ${S}/arch/arm/configs/imx_v7_ottbox_defconfig
${S}/.config
   cp ${S}/arch/arm/configs/imx_v7_ottbox_defconfig
${S}/../defconfig
fi
}
```

freescale ™

3, appoint new defconfig file (cont.)

- Similarly, in *linux-imx-mfgtool_%.bbappend* add:

```
…
do_configure_append() {
if [ "${MACHINE}" = "imx6dlottbox" ] || [ "${MACHINE}" =
"imx6qottbox" ]  ; then
   # copy latest defconfig for imx_v7_ottbox_defconfig  to use
   cp ${S}/arch/arm/configs/imx_v7_ottbox_mfg_defconfig
${S}/.config
   cp ${S}/arch/arm/configs/imx_v7_ottbox_mfg_defconfig
${S}/../defconfig
fi
}
```

the last step of adding a layer

After creating the build directory and before bitbaking any image, we need to modify build/conf/bblayer.conf to add below line:

BBLAYERS += "${BSPDIR}/sources/meta-mylayer"

Agenda

- **Source Codes Changes**
  - ➢ **U-boot**
  - ➢ **Linux Kernel**
  - ➢ **Device Tree**

- **Yocto Project Modification**

- **Image Building Instructions**

- **QA**

Image Building Instructions

1. get Yocto L3.14.28_1.0.0_GA source code, following user's guide

```
mkdir ~/fsl-release-bsp

cd ~/fsl-release-bsp

git config --global user.name "vmuser"

git config --global user.email "vmuser@freescale.com"

git config --list

repo init -u git://git.freescale.com/imx/fsl-arm-yocto-bsp.git -b imx-
    3.14.28-1.0.0_ga

repo sync
```

2. apply the addon tarball in directory ~/fsl-release-bsp

```
tar xvjf fsl-release-bsp_L3.14.28_1.0.0_GA_addon.tar.bz2
```

Image Building Instructions (cont.)

3. configure for different boards of OTTBox

imx6q, rootfs in emmc:

```
MACHINE=imx6qottbox_emmc  source  fsl-setup-release.sh
    -b build-x11  -e x11
```
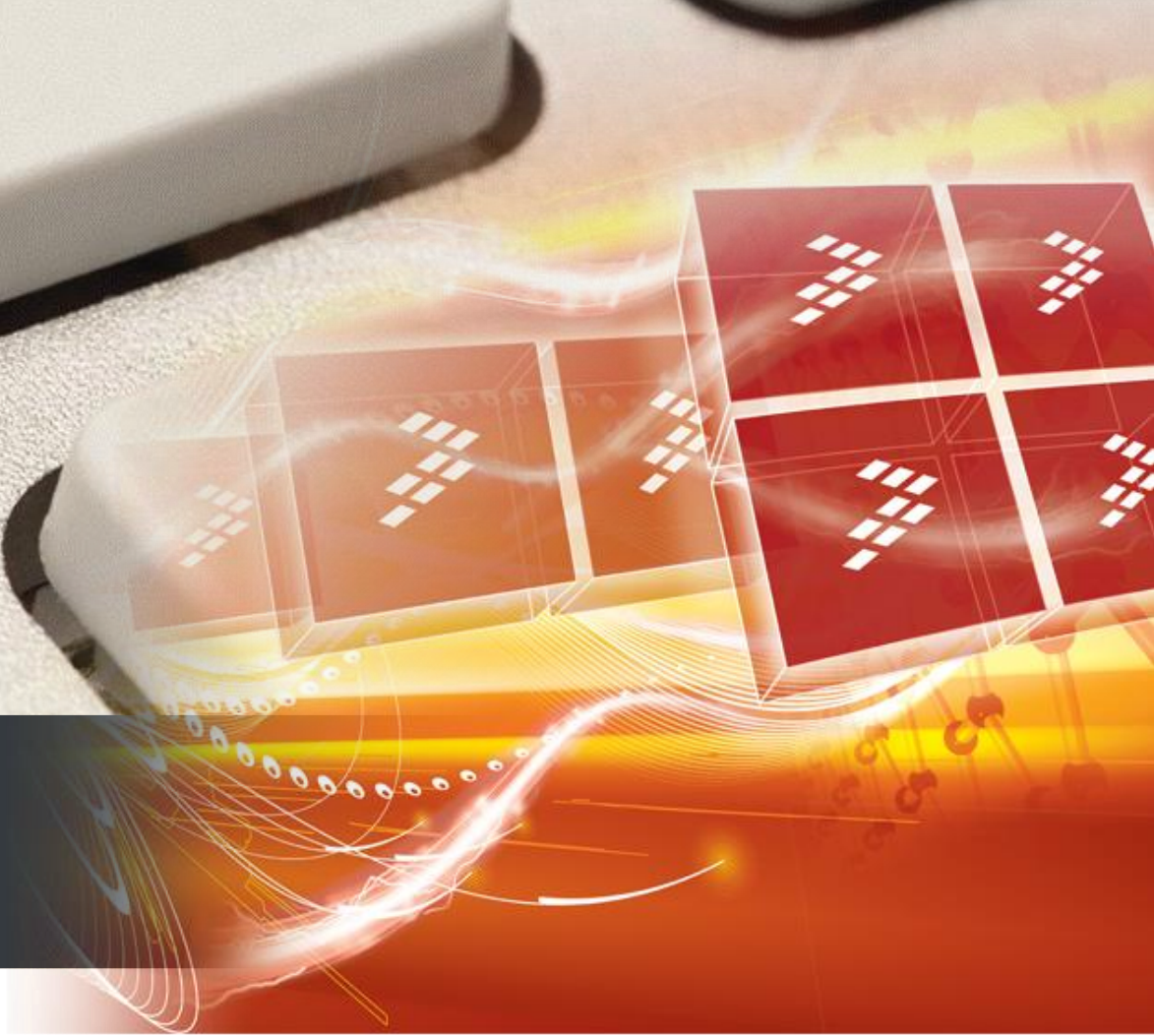
4. modify build/conf/bblayers.conf, add below line

```
BBLAYERS += "${BSPDIR}/sources/meta-mylayer"
```

5. bitbake images

Commands	Generated Image
bitbake fsl-image-gui	Gui Image
bitbake fsl-image-qt5	QT5 Image
bitbake u-boot-imx	U-boot image only
bitbake linux-imx	Kernel and device tree only
bitbake fsl-image-mfgtool-initramfs	MFGTool firmware images: u-boot, kernel, device tree and init ramfs.

freescale ™

Q & A

freescale™

www.Freescale.com